TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

SANNI AUMALA

THE ELECTRICITY LEGISLATION FRAMEWORK OF THE EUROPEAN UNION FROM RESIDENTIAL CUSTOMERS' NETWORK TARIFFS POINT OF VIEW

Master's Thesis

Examiner: Professor Pertti Järventausta
Examiner and topic approved by the Council of the Faculty of Computing and Electrical Engineering on 1st February 2017.

ABSTRACT

SANNI AUMALA: The electricity legislation framework of the European Union from residential customers' network tariffs point of view
Tampere University of Technology
Master of Science Thesis, 71 pages, 2 Appendix pages
November 2017
Master's Degree Programme in Electrical Engineering
Major: Power Systems and Market
Examiner: Professor Pertti Järventausta

Keywords: legislative framework, European Union, energy legislation, energy strategy, standardisation, Energy Union, Clean Energy Package, energy transition, active customer, distribution network, network tariff, tariff structure

Lisbon treaty from 2007 sets high level objectives and gives mandate to EU level energy framework. The EU energy strategies give direction, targets and aims, which are implemented in EU legislation through the ordinary legislative procedure. The energy legislation is becoming more ambitious and detailed, aiming for a more interconnected and customer-centric European energy network. The influencing points at the strategy to implementation process are the best in the legislation preparation and adoption.

The energy transition brings new players and solutions to the electricity system. This creates new needs and roles. The distribution network is in the heart of the transition, connecting more distributed and smaller production facilities, electric vehicles and storages in a smarter way with better technologies, smart grids and smart meters. More flexible resources are needed and used. The transition brings an urgent need for distribution network tariff review. Problems emerge when distributed energy volumes decrease but peak loads can increase due to distributed production.

The distribution network tariffs have a possibility and a need to be updated. New tariff structures make use of the better technologies and communication systems as well as the emerging active customers. The capacity based tariffs are needed to reflect the system use in a better way without blocking the signals needed for the electricity markets.

The EU has noticed the evolution of the distribution system. Currently they debate the Commission's proposal for updated energy legislation. The Clean Energy Package proposes a European approach to systematically, with active customer in charge, take into consideration the emerging electricity system changes. The package also proposes distribution tariff legislation at EU level. Currently, the network tariffs mainly answer for the traditional system's needs. The proposal therefore introduces common principles to fit the modern system. However, the EU level harmonisation of distribution network tariffs is unlikely, even if common principles would be introduced.

TIIVISTELMÄ

SANNI AUMALA: Euroopan unionin sähkömarkkinalainsäädännön viitekehys pienasiakkaiden verkkotariffien näkökulmasta
Tampereen teknillinen yliopisto
Diplomityö, 71 sivua, 2 liitesivua
Marraskuu 2017
Tieto- ja sähkötekniikan diplomi-insinöörin tutkinto-ohjelma
Pääaine: Sähköverkot ja -markkinat
Tarkastaja: professori Pertti Järventausta

Avainsanat: lakiviitekehys, Euroopan unioni, energialainsäädäntö, energiastrategia, standardit, energiaunioni, Puhtaan energian paketti, energiamurros, aktiivinen kuluttaja, jakeluverkko, verkkotariffi, tariffirakenne

Lissabonin sopimus vuodelta 2007 valtuuttaa kaikkia EU:n energiatoimia. Kansainväliset ja EU-tason energiastrategiat luovat tavoitteet ja päämäärät, jotka realisoidaan EU-lainsäädännössä tavallisen lainsäätämisjärjestyksen kautta. Energiatavoitteet ovat koko ajan kunnianhimoisempia, ja tähtäävät yhtenäisempään ja asiakaslähtöisempään eurooppalaiseen sähköjärjestelmään. Sidosryhmien vaikutusmahdollisuudet ovat parhaat lain valmistelu- ja käsittelyvaiheessa.

Energiamurroksen myötä uusia toimijoita ja ratkaisuja ilmaantuu osaksi järjestelmää, tuoden mukanaan uusia tarpeita ja rooleja. Jakeluverkko on murroksen ytimessä yhdistäen hajautettuja ja pieniä tuotantolaitoksia, sähköautoja sekä varastoja entistä älykkäämmin osaksi sähköjärjestelmää. Apuna ovat uudet teknologiat, älyverkko sekä älymittarit. Joustavia resursseja tarvitaan ja käytetään murroksen myötä aiempaa laajemmin. Energiamurroksessa myös jakeluverkkoyhtiöiden tariffien uudelleenarviointi on tarpeen. Ongelmia syntyy, kun siirretyt energiamäärät pienenevät, mutta huipputehot saattavat jopa kasvaa hajautetun tuotannon lisääntyessä.

Jakeluverkkotariffeilla on mahdollisuus ja tarve muuntua vastaamaan uudistuvaa järjestelmää. Tariffit pystyvät hyödyntämään teknologian ja kommunikaatiojärjestelmien kehitystä, ja kannustamaan asiakkaita osallistumaan aktiivisemmin. Tehopohjaiset tariffit ovat tarpeen, jotta sähköjärjestelmän kustannukset saadaan jaettua reilusti, ilman kuluttajia ohjaavien markkinasignaalien heikentymistä.

EU-tasolla on reagoitu jakeluverkon kehitykseen. Juuri nyt keskustelua käydään komission energialainsäädäntöehdotuksesta, Puhtaan energian paketista, joka esittää muun muassa asiakaslähtöistä lähestymistapaa energiamurrokseen sekä uudistuksia verkkotariffeihin. Nykyisin EU-jäsenvaltioiden jakeluverkkotariffit vastaavat perinteisen järjestelmän tarpeisiin, ja komissio esittääkin yhteisiä tariffiperiaatteita, jotka huomioisivat paremmin uuden järjestelmän tarpeet. Jakeluverkkotariffien yhtenäistäminen on kuitenkin epätodennäköistä yhteisistä periaatteista riippumatta.

PREFACE

This thesis was written as an individual study for Tampere University of Technology, the Faculty of Computing and Electrical Engineering. The examiner of the thesis was Pertti Järventausta. I have had the privilege to write the thesis in an inspiring environment in the heart of Brussels, with the best support I could have asked for. The year has been rewarding, to say the least.

I would like to give my thanks to Pertti for guidance, instructions and excellent conversations which helped in pulling the thesis together. I would also like to thank everyone who was a part of my journey at Tampere University of Technology: teachers, friends and family.

Jussi, you have been there for me at all times during this process. Thank you for your patience, support and encouragement.

Special thanks to Anna-Kaisa Itkonen, Paul de Wit and Gilda Amorosi for their help and knowledge, and to all EURELECTRIC staff for their support.

In Brussels, 31 October 2017

Sanni Aumala

CONTENTS

LIST OF ABBREVIATIONS

ACER	Agency for the Cooperation of Energy Regulators
ALDE	Alliance of Liberals and Democrats for Europe
AMR	Automatic meter reading
Art.	Article
BEUC	European Consumer Organisation
CEER	Council of European Energy Regulators
CEN	The European Committee for Standardisation
CENELEC	The European Committee for Electrotechnical Standardisation
CEP	Clean Energy for All Europeans, also: Clean Energy Package, Winter Package (working name)
Coreper	European Council permanent representatives
CPP	Critical Peak Pricing tariff
DER	Distributed energy resources
DSO	Distribution system operator
DSO entity	A European network for Distribution System Operators (working name)
DG	Directorate-General
EC	European Commission
ECR	European Conservatives and Reformists
EEC	European Economic Community
EFA	The Greens / European Free Alliance
EFDD	Europe of Freedom and Direct Democracy
EFTA	European Free Trade Association
ENF	Europe of Nations and Freedom
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSO-G	European Network of Transmission System Operators for Gas
ENVI	Committee on Environment, Public Health and Food Safety
EPP	European People's Party
ETS	Emissions trading scheme
ETSI	European Telecommunications Standards Institute
EU	European Union
EU Council	Council of the European Union
EURELECTRIC	The Union of the Electricity Industry
EV	Electric vehicle
EWP	Energy Working Party
GL	Guideline
GUE	European United Left
IBR	Inclining block rate
ICT	Information and communications technology
IEC	International Electrotechnical Commission
IGD	Implementation Guidance Document
IMCO	Committee on Internal Market and Consumer Protection
ITRE	Committee on Industry, Research and Energy
kW	Kilowatt
kWh	Kilowatt hour

MEP	Member of European Parliament
MMR	Manual meter reading
MS	Member State
NC	Network Code
NGL	Nordic Green Left
NI	Non-Attached Members
NRA	National Regulatory Authority
NSB	National standardisation bodies
OJEU	Official Journal of the European Union
PLT	Power limit tariff
PT	Power tariff
pv	photovoltaic
Q	Quarter (of a year)
ROC	Regional Operation Centre
RSC	Regional Security Coordinator
S&D	Progressive Alliance of Socialists and Democrats
ST	Step tariff
ToU	Time-of-Use
TPT	Threshold power tariff
TSO	Transmission system operator
TTE	Transport, Telecommunications and Energy Council
V2G	Vehicle-to-grid services

1. INTRODUCTION

The whole energy industry is in transition. This can be seen in all areas, including buildings and transportation, products and services, systems and politics. In electricity industry it shows all the way from electricity networks and their operation to electricity generation and market, in consumer involvement and in the energy legislative framework.

Behind the transition there are, to name a few factors in no specific order:

- development of technologies, communication tools, IT tools and materials,
- running out of natural resources such as oil, natural gas and coal,
- the understanding of climate change and the increasing popularity of green values which is shaping the industry policies and showing in politics,
- the globalisation which is leading to more harmonised European energy networks, rules and policies.

On top of the natural development, international agreements and national and European energy regulation and policies are setting further targets for the energy transition in Europe. These targets are becoming more ambitious, trying to find a more ecological and cost-efficient way forward. At the same time the targets need to balance between existing and future energy systems and system users as well as between the related existing and upcoming legislative needs.

This thesis takes a look at the European legislative framework in the middle of energy transition, with the focus on the distribution networks and more specifically the distribution network tariffs. For the purposes of this thesis, the key stakeholders considered are the institutions and organisations working with or for the energy legislation, standards and policies at European level, distribution system operators (DSOs) and the distribution network residential customers.

The main objectives of the thesis are:

- To clarify the European strategy and legislative processes and influencing in the field of electricity.
- To analyse the electricity legislative framework in energy transition.
- To research and analyse European electricity legislative framework from residential customer's network tariffs point of view, with the aim to link the analysis to the needs and interests coming with the energy transition.

By clarifying the process from European strategy to national implementation in the energy field, especially focusing on the electricity, the thesis aims at understanding the big picture of the policy cycles and identifying the key influencing opportunities.

As many of the changes coming with the energy transition impact especially the distribution level structure, dynamics and customers, the European network tariff framework for residential customers is taken under review. The review also showcases the legislative processes and influencing at European level in practice. With the case analysis, the aim is to figure out how and why the legislative framework for network tariffs has developed to what it is, and how it will presumably develop in the future.

In more detail, the thesis aims at answering the following research questions:

- How is the European Union (EU) energy legislative framework developing in time and how does it pass from EU strategy to implementation?
- What are the influencing opportunities in relation to the European energy legislation and standard frameworks?
- How is the energy transition changing the electricity system and its needs?
- How have the distribution network tariff needs changed in the energy transition and how does it reflect to the EU legislative framework?

The thesis is structured to first, in chapter 2, introduce the key EU bodies and organisations and their roles and responsibilities, the European strategy and legislation setting processes, the standard setting process. Chapter 2 also describes the strategy to implementation process of the EU energy legislation and the influencing opportunities related.

The developing energy system is explained, from electricity point of view, in chapter 3. The chapter introduces the key elements of the energy transition and potential changes and trends foreseen. Chapter 4 describes the distribution network tariffs at EU level. First the chapter focuses on the electricity pricing, then on network tariffs' objectives and different components and methodologies. The chapter also introduces flexibility services.

In chapter 5 the thesis takes a deeper look into the European distribution network tariff framework. The chapter focuses on the distribution tariffs' changing needs and structures in the energy transition, and takes a look at the most recent development in the EU legislation related to distribution network tariffs. The conclusions of the thesis are gathered to chapter 6.

1.1 Research methodology

This research aims at giving a new perspective for European energy legislation cycle, EU energy legislation influencing and the concrete developments related. This is done by compiling the information and knowledge of various governmental institutions, associations and academic publications. The research approach is inductive, meaning that the study is based on the principle of developing theory after collecting the data

(Saunders, Lewis, & Thornhill, 2009). This approach applies especially for the strategy to implementation cycle and influencing framework developed.

This thesis has been approached from purely European perspective, focusing on the transformation of the EU electricity system and related EU legislation as a whole. Due to the energy legislative perspective of the thesis, a major part of the information is based on the information available at the governmental institutions' websites, studies and reports published, and on the recent years' legislative acts and proposals for such. All sources used are as recent as possible, in order to reflect the most recent developments.

The distribution network tariffs have been approached with a limited number of most recent studies from Finland and the UK, based on their availability and their suitable research questions. The stakeholder views related to network tariffs were chosen from regulator, transmission and distribution system operator, market, generation and customer perspective to get the whole value chain represented in views. For energy regulators, CEER was a clear choice as the European entity for regulators, as for transmission system operators ENTSO-E. EURELECTRIC was chosen as they represent the market, generation and DSOs, EDSO for smart grids as they represent the largest DSOs and BEUC as a customer organisation.

1.2 Disclaimer

For clarification, it should be stated that while working on this Master's Thesis the author has been employed by The Union of the Electricity Industry, EURELECTRIC. However, this thesis does not represent EURELECTRIC or its opinions in any form but is an individual research done for Tampere University of Technology.

2. THE ENERGY LEGISLATIVE FRAMEWORK IN THE EU

The EU provides its Member States with different levels of energy-related guidance: treaties, strategies, binding legislation and decisions, non-binding standards, resolutions and opinions. There are also other kinds of products, such as EU institutions' internal regulations or action programmes. (EUR-Lex, 2017b)

The EU strategies and legislation have to be implemented at national level and the existing Member State strategies and legislation amended to comply with them. Content wise the EU strategies and legislation are reflecting the views, plans, positions, practices and legislative content of the EU Member States, and the Member States are always included in the legislation preparation processes. In this way the relation of EU and Member State actions and products is interactive.

The EU aims at harmonised rules in key issues: a framework which can then be implemented in more detail depending on the national needs and interests, still ensuring the benefits of cross-border co-operation. One of the reasons behind the European level harmonised rules is making the co-operation between the stakeholders, such as the energy producers, system operators and manufacturers, easier. Another reason is the aim for a secure, competitive and low-carbon European energy sector and a pan-European internal energy market (ENTSO-E, 2017). The latter reason also has brought more technical detail into the European-wide energy legislation.

This chapter first shortly describes the European Union and the EU energy legislation and standardisation institutions. The law and standards preparation processes in the EU are described in chapter 2.3, after which the EU energy strategy and legislation frameworks are introduced. Finally, in 2.6 and 2.7, the chapter is pulled together with a flowchart of the strategy to implementation process and with an overview of the EU energy strategy, legislation and standard influencing.

It is good to keep in mind that chapter 2 is written with the focus on the electricity sector. Other than electricity-related energy legislation processes closely follow the same format as presented. However, the committees, institutions and bodies partly vary in name and composition.

2.1 European Union

Before becoming European Union as we know it, the union was purely economical and known as European Economic Community (EEC), established in 1958 between six Middle European countries. With more and more co-operation in expanding policy are-

as – climate, security and health, etc. – the name was changed to European Union in 1993. (EU, 2017d)

In 2017, the EU has 28 Member States, 5 candidate countries and one, United Kingdom, in the process of leaving the EU after a referendum (EU, 2017a). The term Member State is used for any country that is a member of the European Union.

The Member States are directly involved in the decision-making processes in the EU, citizens represented through the European Parliament and the Member States through the European Council and the Council of the European Union. Reciprocally, they must nationally implement the EU rules and regulations.

2.2 The EU institutions for energy regulation and policy

The European legislation processes and the different legislative bodies are complex in their compositions, roles and relations. On top of empowered entities and bodies there are e.g. working groups, sub groups, committees, advisory groups, co-operative organisations and different kinds of platforms involved in the processes.

The following EU institutions are the closest related to the energy, as well as other, legislation and policy preparation and approval processes (EU, 2016a):

- European Commission (later: Commission),
- European Parliament (later: Parliament), and
- Council of the European Union (later: EU Council).

This chapter introduces the above mentioned EU institutions and the European Council which has an important role in the priority setting of the EU.

2.2.1 The European Commission

The European Commission, originating from the High Authority of the European Coal and Steel Community from 1951, represents the interests of the European Union as a whole. It takes decisions on the EU's political and strategic direction and has the power to decide which law proposals are passed to the Parliament and the EU Council for adoption. (EU, 2016a)

The policy department structure of the Commission is built under the college, which has one representative from each EU country, rotating every 5 years. The college takes decisions on policies' and strategies' direction and can propose laws, funding programmes and budgets. There are different roles within the college: President, first Vice-President, Vice‑President and High Representative for Foreign Policy and Security Policy, 5 Vice-Presidents and 20 Commissioners. (European Commission, 2017i)

The policy departments are called Directorates-General (DGs), led by a Commissioner and a Director-General. The department for Energy union and climate – but also jobs, growth and investment – is called DG ENER. The role of a DG covers policy, law and funding programme development, implementation and management.

The Commission has offices in both Brussels and Luxembourg, and meetings weekly in both Brussels and Strasbourg. In addition to the EU offices, there are representation offices in each EU Member State as well as delegations outside the EU.

2.2.2 The European Parliament

The Parliament, established as Common Assembly of the European Coal and Steel Community in 1952, developed to the current format of the European Parliament in 1962 and represents the EU citizens. Its members have been directly elected by the citizens since 1979 and it has three main responsibilities in legislative, supervisory and budgetary areas. The elections are held every 5 years. (EU, 2016a)

There are currently 751 seats in the Parliament in total, shared between Member States based on their population. However, as set in the rules of the Parliament, no Member State has less than 6 seats.

Each member of the European Parliament, also called a MEP, is categorized in a political group of the Parliament. Instead of parties these groups are coalitions: national political parties and European parties are gathered under these groups based on their shared main interests and the independent MEPs are gathered to one group.

The political groups of the Parliament, in the alphabetical order of the abbreviations, are (European Parliamentary Research Service Blog, 2017):

- Alliance of Liberals and Democrats for Europe (ALDE)
- European Conservatives and Reformists (ECR)
- Europe of Freedom and Direct Democracy (EFDD)
- Europe of Nations and Freedom (ENF)
- European People's Party (EPP)
- The Greens / European Free Alliance (EFA)
- European United Left (GUE) / Nordic Green Left (NGL)
- Non-Attached Members (NI)
- Progressive Alliance of Socialists and Democrats (S&D)

The two biggest of these groups are EPP and S&D. A slash between two groups in the list above symbolizes the co-operation (alliance) of those groups. NI represents the independent MEPs.

The Parliament's work is partly done in the committees, partly in plenary sessions. There are 23 different committees and 2 subcommittees that examine proposals for legislation, each in their own topics and work areas. (European Parliament, 2017b)

The committees working on energy-related topics are:

- Committee on Internal Market and Consumer Protection (ITRE),
- Committee on Environment, Public Health and Food Safety (ENVI) and
- Committee on Industry, Research and Energy (IMCO).

In the committees and subcommittees MEPs and the Parliament's political groups can put forward their amendments to the legislation proposals. The final vote on the work prepared in the committees (proposed legislation and proposed amendments) takes place in so called plenary sessions. All MEPs can participate in the vote and the debates in the plenary sessions.

On top of what is already mentioned above, the Parliament has a president who is elected for a renewable two and a half years. There are also 44 delegations which maintain relations and exchange information with non-EU countries' parliaments.

2.2.3 The Council of the European Union

The Council of the European Union is also commonly known as the EU Council. It was established in 1958 and it represents the governments of the individual Member States, as it is composed of government ministers from each EU country. Its meetings and votes are held in public, and the composition of the participants depends on the topics and subjects being discussed. The EU Council takes part in negotiating and adopting EU laws together with the Parliament. It also coordinates and develops certain EU policies and concludes international agreements, as well as shares the budgetary responsibility with the Parliament. The EU Council can make decisions with a majority or with a unanimous agreement, depending on the subject. (EU, 2017b; European Council, 2017)

The Presidency of the EU Council is shared by the Member States on a rotating basis, changing every six months. For example in December 2016 the presidency was rotating to the Maltese, after which to Estonians, and so on. (EU, 2016a)

There are more than 150 working parties and committees that take part in the preparations of the Member State ministers' work. The working party officials come from the EU Member States.

2.2.4 The European Council

The European Council should not be confused with the Council of the European Union, although they share the building and the secretariat (European Council, 2017). The Eu-

ropean Council meets four times a year, in meetings often referred to as EU summits, and defines the EU's overall political direction and priorities. It is not one of the legislating institutions as the EU Council is, and does not negotiate or adopt EU laws. (EU, 2017e)

The European Council members consist of the heads of state or government of the 28 Member States, the European Council President who is elected every 2,5 years and the President of the Commission. Also the High Representative of the Union for Foreign Affairs and Security Policy (chief coordinator and representative of the Common Foreign and Security Policy within the EU), takes part in the European Council meetings, but only when foreign affairs issues are discussed.

The decisions of the European Council are mostly made by consensus. However, in specific cases outlined in the EU primary law, it decides by unanimity or by qualified majority of the heads of state or government. (EU, 2017e)

2.2.5 Other entities impacting the energy regulation and policy

In addition to the Parliament, the EU Council, the European Council and the Commission, certain entities are very much involved in the processes of setting electricity and energy legislation. The entities in the list below are following mandates given in the EU energy legislation:

- Agency for the Co-operation of Energy Regulators (ACER)
- European Network of Transmission System Operators for Electricity (ENTSO-E)
- European Network of Transmission System Operators for Gas (ENTSO-G)

The Agency for the Co-operation of Energy Regulators, ACER, is, as it stands, a European body complementing and coordinating the work of national energy regulators in the Member States, working towards the completion of the single European energy market for electricity and natural gas. They contribute to market integration and also monitor both ENTSOs' work and plans concerning European network, the functioning of markets and wholesale energy trading.

ACER is composed of permanent staff and seconded energy experts from Member States' national regulatory authorities (NRAs). The establishment of ACER was set in the Third Energy Package in 2009 and it started its operation in 2011. To oversee ACER's activities there are three boards composed of senior representatives, members appointed by European institutions and former staff of competition authorities or other national or Community institutions.

European Network of Transmission System Operators for Electricity and Gas, ENTSOs, work was also given mandates and established in the Third Energy Package, in 2009.

ENTSO-E represents 43 transmission system operators (TSOs) from 36 countries. It is governed by an assembly which represents the TSOs and by a board which consists of 12 elected members (ENTSO-E, 2015a). ENTSO-G represents 45 gas TSOs and 2 associated partners from 26 countries. (ENTSO-G, 2014)

ENTSOs' objective is to set up an EU internal energy market and to optimise its functioning, taking into consideration the integration of renewables, further use of flexibility and increasing customer involvement. One of the core work items for ENTSOs was decided to be developing security standards and drafting technical network codes to help harmonise the flow of electricity and gas across borders (ENTSO-E, 2017). These sets of binding codes and guidelines helping the cross-border operations are called Network Codes (NCs) and Guidelines (GLs). NCs and GLs state for example the use, and conditions of use, of networks and third party access. The difference between NCs and GLs is in the level of detail: NCs are more detailed than GLs where GLs are amended in detail in the implementation phase with methodologies. Each NC applies to one or more parts of the energy sector. In 2017, most of the network codes and guidelines drafted in the first set have entered into force and are now in the national implementation phase.

On top of developing NCs and GLs ENTSOs produce policy positions, contribute to regional security coordination, publish reports and develop long-term network plans.

Most recently, an EU body for distribution system operators (DSO entity) has been introduced in the Clean Energy for All Europeans Package, which is currently in the adoption process. If the proposal of a DSO entity survives through the process, it will be established and given mandates after the entry into force of the package as set in the final legislation.

2.3 Standardisation and the related EU bodies

On top of the binding energy regulation the Member States are provided with non-binding guidance, rules and other documents, such as standards. By complying with European standards it is easy for the industry to prove that they also comply with the European legislation. Inadequate standards can lead to various and incompatible solutions, to additional costs and to inconvenient use of systems. Therefore it is in the interest of the industry to establish common, comprehensive standards that can be approved by all related parties. Although standards are not binding like the legislation, they give a strong message on how to fulfil the requirements set in the European legislation.

As with European legislation, European standards overrule the national standards. There is however one more layer, as international standards overrule the regional standards. The international standards are prepared where the efficiency of production or international trade can be improved, or where there is a need for harmonised regulations. (ISO, 2017)

European energy standards are developed through one of the three European Standards Organisations:

- the European Committee for Standardisation (CEN),
- the European Committee for Electrotechnical Standardisation (CENELEC) or
- the European Telecommunications Standards Institute (ETSI).

The EU standardisation bodies signed an agreement and started working with the Commission in 1984. (European Commission, 2017h)

The international equivalents of CEN, CENELEC and ETSI are (ISO, 2017):

- ISO (International Organization for Standardisation),
- IEC (International Electrotechnical Commission) and
- ITU (International Telecommunication Union).

CEN includes the national standardisation bodies of 33 European countries, consisting of the EU Member states and European Free Trade Association (EFTA) countries. It provides a platform for the development of European standards and technical documents on different types of products, materials, services and processes. Member States can access CEN only through the national standardisation bodies (NSBs). (European Commission, 2017h)

CENELEC is responsible for standardisation in the field of electro-technical engineering. CENELEC prepares standards in order to help facilitate cross-border trade and new markets access, to cut compliance costs and to support the development of the EU Single Market. CENELEC is in close collaboration with the International Electrotechnical Commission (IEC). The EU Member States can access CENELEC, just like CEN, only through the NSBs. (European Commission, 2017h)

ETSI differs from CEN and CENELEC by involving industry straight in the standardisation processes. ETSI produces standards for information and communications technology (ICT), in a globally-applicable format. (European Commission, 2017h)

The work of the standardisation bodies is sometimes requested or kicked off by European legislation. The preparation of such legislation-linked standards is relevant after the legislation is adopted and will enter into force. After entry into force the relevant related standards are evaluated for the needs for modification. Also the need for new standards has to be considered.

The standardisation work is done in different kinds of technical bodies, e.g. technical committees, sub-committees, working groups, sector fora which have an industry overview and the technical board which is coordinating the work. Different kinds of horizontal structures, such as CEN-CENELEC coordination groups, have also been formed, for example to work on standards on smart meters. (CENELEC, 2017)

2.4 Legislative and standardisation procedures

The most common legislative procedure at the EU level is known as the ordinary legislative procedure. In this procedure the European Parliament has to approve EU legislation together with the EU Council. (EU, 2016b)

The ordinary legislative procedure gives the same weight to the Parliament and the EU Council in the adoption process of the legislation. The vast majority of European laws are adopted with this procedure (European Parliament, 2016b). The ordinary legislative procedure is also the procedure used for energy-related legislation as set in Lisbon treaty (EU, 2007). The Lisbon treaty is further described in chapter 2.6.

The European standards are not a part of the European legislation although their role is to support it. Also the entities and organisations related are separate from EU legislative entities. Therefore the standards have their own adoption procedure.

This chapter describes the ordinary legislative procedure's steps from a proposal to adoption in sub-chapter 2.4.1. The standardisation procedure is explained in sub-chapter 2.4.2.

2.4.1 The ordinary legislative procedure

Parliament and the EU Council, after receiving the Commission's proposals for European policies and laws, produce through ordinary legislative procedure binding legislation that applies throughout the EU. The ordinary legislative procedure is explained in figure 1. The procedure is divided into seven parts. The green boxes show the parts which can lead to adoption of the legislation, the red boxes the termination possibilities of the procedure.

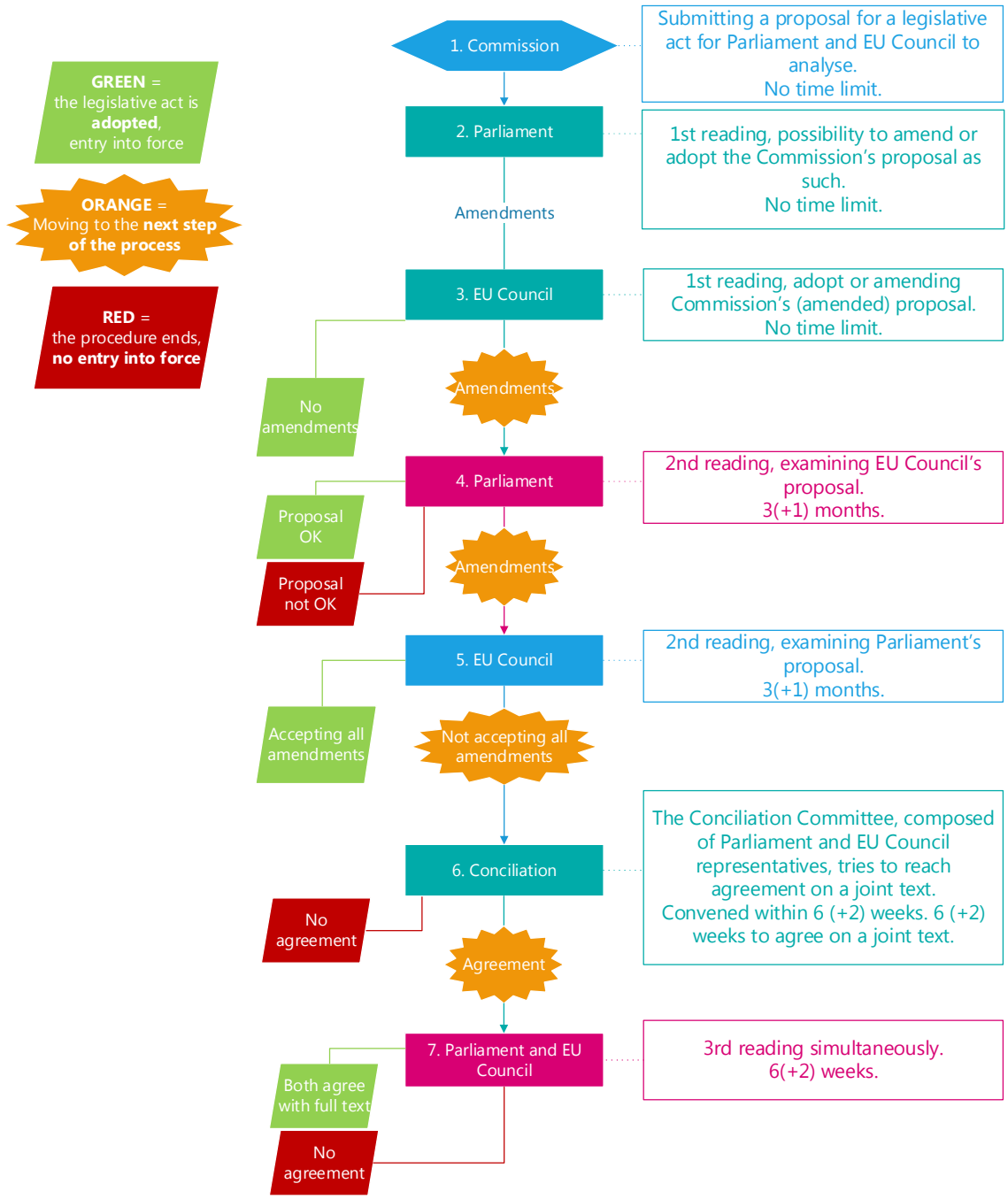


Figure 1. The ordinary legislative procedure, based on (European Parliament, 2016b).

At step 1 of figure 1, the Commission publishes a legislative proposal and it goes to the Parliament and the EU Council simultaneously for examination, also called the first reading. At any time of the first reading, the Commission has the power to withdraw or alter its proposal. As seen from figure 1, there can be up to three readings before the EU Council and the Parliament either agree on (with or without amendments) or reject a legislative proposal. (EU, 2017c)

The steps 2 and 3 are overlapping. However, the process is set in two as the EU Council's position can't be adopted before the Parliament has delivered its first reading opinion. If there is a common agreement between the EU Council and the Parliament, it is

possible to adopt the legislation proposal already after step 3. If there are amendments by the EU Council after the Parliament's opinion, the process leads to step 4 and the Parliament has 3 months to examine the EU Council's further amendments. Informal meetings called trilogues might take place in order to find consensus between the co-legislators already in the first reading round.

In the figure 1, the time for each step has been marked. The number in brackets marks the delay that can be added to the timetable. The first three steps have no time limit.

The step 4 starts the second reading round, in which the Parliament has the options of approving the proposal with the EU Council's amendments (leading to the adoption of the legislation), disapproving the proposal (leading to the termination of the process), or making further amendments, which takes the process to step 5. They have 3 months to come to a conclusion. If the process continues to step 5, the EU Council starts the second reading and has 3 months to examine the latest proposal. The EU Council's options are to approve or disapprove all further amendments, leading to either the adoption of the legislation or the next step of the process: the Conciliation Committee.

As in the first reading, agreement can be searched for in informal bilateral or tripartite meetings prior to taking votes. These meetings take place with the Parliament's and the EU Council's representatives, and in case of tripartite meetings including also Commission.

If the process continues to step 6, a Conciliation Committee is gathered from both Parliament and EU Council representatives around a table in 6 weeks' time. There are trilogues and technical meetings arranged outside the Conciliation Committee, through which teams of negotiators from both the Parliament and the EU Council can negotiate the topics with their delegations. The Conciliation Committee has another 6 weeks to come to an agreement on the amendments. If an agreement is not reached, the legislative procedure is terminated. Otherwise the agreed amendments go to a third reading to the Parliament and the EU Council simultaneously.

In the 7th step both entities need to agree on all of the Conciliation Committee's proposed amendments within 6 weeks' time. If either disagrees, the procedure is terminated. With an agreement the legislation is adopted.

If the proposal is adopted, the legislative texts are published in the Official Journal of the European Union (OJEU). After publishing the legislation becomes official and binding as of the date set down in the OJEU. After entry into force, the Commission and the Member States go through an implementation process, and it is the Commission's duty, through monitoring of the legislation, to ensure that the laws are properly applied and implemented. There are also three possibilities for the procedure to come to an end without the proposal entering into force. A terminated procedure means that the Com-

mission has to come up with another legislation proposal and the ordinary legislative procedure is started only with such new proposal.

2.4.2 EU standard preparation

The European energy standards are prepared by CEN, CENELEC and ETSI. The general standard-making process is presented in figure 2.

Figure 2. Standardisation process, based on (CEN, 2017).

In the standard-preparation process, a proposal to prepare a European standard, step 1 in figure 2, can come from any interested party. The proposal needs to be accepted by the relevant technical body and technical board at European level, step 2 in figure 2. The acceptance of a proposal stops any work-in-process in the related area at the national standardisation bodies and starts the drafting phase, shown as step 3, inside the European standardisation body that accepted the proposal.

A draft standard goes through public comments at national level. This is the step 4 in figure 3. A comment can be provided by any interested party. The weighted vote shows the members' national position to the draft and is submitted by the national standardisation bodies. The results of the enquiry are analysed by the responsible technical body at the European level. If the results of the step 4 show approval for the draft standard, the responsible technical body can decide to publish the standard.

The step 5 is only relevant if the enquiry result is negative. At this point, draft standard needs technical reworking by the relevant technical committee. The updated draft is resubmitted for another weighted vote at national level, which is now called the Formal Vote.

A positive enquiry resulting from step 4 or step 5 leads to publication of the standard (step 6). A European published standard replaces the national standard where they overlap, becoming the new national standard as in step 7. The national standards conflicting with the published European standard need to be withdrawn. Also modifications to existing national or European standards might emerge.

The European standards are reviewed within five years of their publication. The standard can be confirmed, modified, revisioned or withdrawn as a result. This is the last formal step, step 8, of the standardisation preparation procedure at European level.

When talking about harmonised standards, the binding standard framework is set in a directive before the drafting process. In this case, Commission requests for the standard but otherwise the development process follows the standard-making process as in figure 2. Harmonised standard is published in OJEU when it has a positive vote, and the finalised standard is added to the website of the Commission. (Danish Standards Foundation, 2015)

2.5 European energy strategy

As Europe has become more and more dependent on energy, and as actions are taken to fight the climate change, the EU has increasingly introduced common European targets and aims in European strategies, and corresponding rules, legislation and agreements on energy-related issues (EUR-Lex, 2017a). On top of European targets, there are international targets which the EU with other regions has agreed to reach for. The most relevant of such international agreements is the Paris Agreement which addressed climate change and set a global target of limiting the temperature rise to 2 degrees Celsius, to with a strive for 1.5 degrees Celsius. The Paris Agreement was adopted in 2015 with 55 countries accounting for 55 % of the total global greenhouse gas emissions. As of September 2017, already 166 countries have joined the agreement. (United Nations, 2017)

The current EU energy strategies and the corresponding energy policies are driven by three main objectives:

- Security of supply
- Competition
- Sustainability

Of these, the first objective, security of supply, aims at ensuring reliable provision of energy at all parts of Europe at all times. The second objective, competition, aims at ensuring affordability for the energy users. Last but not least, the sustainability of consumption leads to lower greenhouse gas emissions, less pollution and lower dependency on fossil fuels. (European Commission, 2017f)

Some of the most important EU's energy-related strategies include the 2020 Energy Strategy, the 2030 Energy Strategy and the Energy Union. On top of the EU's energy strategies, there have been frameworks provided by the Commission related to the energy strategies. This type of frameworks, for example 2050 Energy Roadmap, might also be called strategies in Commission's communication.

In addition to the mentioned energy strategies, the Lisbon Strategy, published in 2000, should be taken into account when discussing the EU's energy framework. The role of the Lisbon Strategy was triggering for the European energy markets as it introduced an agenda for the coming years. The key message of the Lisbon Strategy was that without improving the competitiveness of the EU's energy markets, the EU would not be the most dynamic and competitive knowledge-based economy in the world. (Karan & Kazdagli, 2011)

The EU's overall political strategy is developed jointly by the European Council, European Council President and the Commission President. The Commission proposes policies and laws, also called measures in relation to strategies, to implement the strategy. Once a year the Commission sets a 12-month action plan which describes the political priorities and actions related to the strategy which will be taking place in that time period. (European Commission, 2017l)

The figure 3 presents an overview of the key energy strategies mentioned above. The adoption years of the strategies are marked above the axis and implementation periods below the axis.

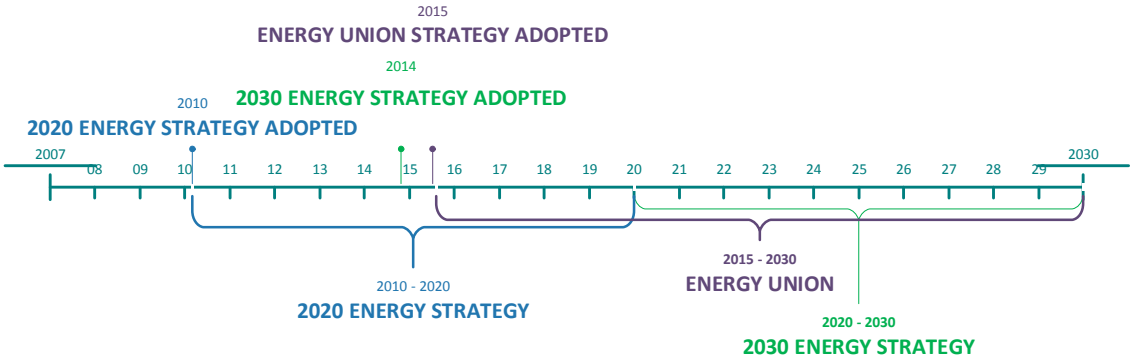


Figure 3. An overview of the EU energy strategies.

The 2020 Energy Strategy, adopted together with the Europe 2020 strategy in 2010, is a strategy targeting for smart, sustainable and inclusive growth by 2020 (European Commission, 2010). Its key priority is sustainable growth, promoting a more resource efficient, greener and more competitive economy.

The key objectives of the 2020 Energy Strategy for 2020 are (European Commission, 2017a):

- 20 % cut in greenhouse gas emissions compared to 1990 levels,

- 20 % of EU energy use produced by renewables, and
- 20 % improvement in energy efficiency.

The Europe 2020 Strategy combined targets for energy and climate change as above, but also employment, research and development, education and poverty and social exclusion. (European Commission, 2017g)

Complementing the EU's energy strategy planning process, the Commission's 2050 Energy Roadmap, published in 2011, gave a long-term vision for the energy transition towards a competitive, secure and sustainable energy system by 2050. The Roadmap aimed for reducing greenhouse gas emissions by at least 80 %. The 2050 Energy Roadmap set out four main routes, ending up with seven different scenarios to a more sustainable, competitive and secure energy system by 2050. The four main routes included energy efficiency, renewable energy, nuclear energy, and carbon capture and storage. (European Commission, 2017c)

The 2050 Energy Roadmap concluded that (European Commission, 2017c):

- Decarbonising the energy system is cheaper than continuing with current policies.
- Energy efficiency and increasing use of renewables are crucial, with any energy mix.
- EU's energy infrastructure is in many parts in the end of its life cycle, and should be replaced with low-carbon alternatives.
- Compared to Member State approach, the EU level approach is expected to cost less and result in better security of supply. This would build on a European energy market.

After the 2050 Roadmap, the 2030 Energy Strategy, adopted by the European Council in 2014, updated the 2020 Energy Strategy by providing targets for renewable energy resources, energy efficiency and greenhouse gas reductions for the period between 2020 and 2030. (Talus, 2015, p. 55)

The key objectives of the 2030 Energy Strategy are (European Commission, 2017b):

- 40 % cut in greenhouse gas emissions compared to 1990 levels,
- at least 27 % of EU energy use produced by renewables, and
- at least 27 % improvement in energy savings compared with the business-as-usual scenario.

To meet the 2030 Energy Strategy objectives, the Commission proposed a reformed emissions trading scheme (ETS), new competitiveness and security of the energy system indicators and first ideas for a new governance system based on national plans, following a common EU approach.

The latest EU energy strategy, Energy Union strategy, was launched in 2015. It consists of 5 policy areas and builds on the 2030 Energy Strategy – also leading way to the so called Paris Agreement of 197 countries (ratification in 2016).

The five policy areas of the Energy Union are:

- Security, solidarity and trust
- A fully-integrated internal energy market
- Energy efficiency
- Climate action - decarbonising the economy
- Research, innovation and competitiveness

The EU's strategies are used as reference frameworks for the EU, national and regional level activities. When an EU strategy is in place, the national governments set national strategies to achieve the EU targets. The national governments report back by annual national reform programmes. The monitoring of the strategies is done with reviews and statistics by the Commission and the EU statistics office, Eurostat.

The energy strategy framework is rather recently developed and has not changed much from the general objectives' perspective. The upcoming strategies will be put in place with the next EU institution presidencies. The Paris Agreement together with the 2050 Roadmap are likely to guide the energy strategies of the future together with the information gained from the monitoring of the 2020, 2030 energy strategies and the Energy Union. Also research and innovation, changing operational environment and changes in values and views impact the upcoming EU energy strategies.

2.6 European energy legislation

Treaties are primary law determining in which areas the EU can pass laws. Treaties lay down the objectives of the EU, the rules for EU institutions, how decisions are made and the relationship between the EU and the Member States. The EU treaties have been amended to reform institutions, to give the EU new areas of responsibility or to allow new EU countries to join the EU. Treaties are negotiated and agreed by all the EU countries, and ratified by national parliaments. (European Commission, 2017m)

Currently, the following four treaties are in force (EUR-Lex, 2017d):

- Treaty on European union (Consolidated version 2016)
- Treaty on the Functioning of the European Union (Consolidated version 2016)
- Treaty establishing the European Atomic Energy Community (Consolidated version 2016)
- Charter of Fundamental Rights of the European Union (2016)

The Treaty on the Functioning of the European Union, also called Lisbon Treaty as it was signed in Lisbon in 2007, introduced an article on the functioning of the European

internal energy market: article 194. The article 194.1 states that the EU should aim at ensuring the functioning of the energy market, security of energy supply in the Union, at promoting energy efficiency and energy saving and the development of new and renewable forms of energy, and the interconnection of energy networks. In article 194.2, the Lisbon Treaty also states that the EU energy legislation should undergo the ordinary legislative procedure, as described in chapter 2.4, and that the measures should be adopted after consultation of the Economic and Social Committee and the Committee of the Regions in order to enter into force. (EEPA, 2017)

Although energy legislation was already introduced at EU level before the Lisbon Treaty, the treaty introduced a legal basis for all upcoming European energy legislation that shares competences between the EU and its Member States. Without this legal basis the energy-related EU actions would always need a more detailed discussion on if they are justified.

Energy-related matters can easily be seen as Member State business, going under the subsidiarity principle. According to the subsidiarity principle, EU legislation shouldn't be made but where national legislation is insufficient. In articles 192 and 194.2 the Lisbon Treaty also states that the EU measures shouldn't affect the Member State rights to determine the conditions for exploiting its energy resources, its choice between different energy sources or the general structure of its energy supply, unless the EU Council, acting unanimously on a proposal from the European Commission and after consulting the European Parliament, the Economic and Social Committee and the Committee of the Regions, makes the ordinary legislative procedure applicable to the matter. (EU, 2007; EUR-Lex, 2017c)

Further legal acts, in addition to treaties, include regulations and directives, decisions, recommendations, opinions and delegated and implementing acts. Often the measures are packages consisting of the mentioned legal acts. In this thesis the focus is limited to regulations and directives. The difference between regulations and directives is that regulations are binding as such in all Member States. Directives are more flexible, introducing binding concrete targets but leaving national flexibility in the means of achieving the target. (European Commission, 2017m)

From the measures taken to reach the objectives of the EU energy strategies, a few legislative packages should be highlighted. The internal energy market policy has been set, step by step, in the first, second and third energy package, adopted in 1996, 2003 and 2009. These measures have guided the way for especially market access, transparency and regulation, consumer protection, supporting interconnection and adequate levels of supply. The two first packages were already introduced before the Lisbon Treaty, the third as a measure related to the 2030 Energy Strategy. (European Parliament, 2017a)

The Third Energy Package, officially the Third Legislative Package for an Internal EU Gas and Electricity Market, is the latest implemented energy legislation. It was the first proposal treating electricity and gas jointly (Talus, 2015). The contents of the Third Energy Package are presented in table 1.

Table 1. The contents of the Third Legislative Package for an Internal EU Gas and Electricity Market.

3 regulations	Regulation on Conditions for Access to the Natural Gas Transmission Networks (715/2009/EC)
	Regulation on Conditions for Access to the Network for Cross-Border Exchanges in Electricity (714/2009/EC)
	Regulation Establishing an Agency for the Cooperation of Energy Regulators (713/2009/EC)
2 directives	Common Rules for the Internal Market in Electricity Directive (2009/72/EC)
	Common Rules for the Internal Market in Natural Gas Directive (2009/73/EC)

The Third Energy Package introduced in particular the following elements:

- unbundling rules for the companies to separate the generation and supply interest from the operation of the networks;
- stronger legislation for the transparency of retail market;
- consumer protection rules strengthened;
- the establishment of ACER and strengthening the independence of regulators:
- the establishment of European Network for Transmission System Operators (ENTSO); one for electricity, one for gas.

The Clean Energy for All Europeans, legislation package published by the Commission in November 2016, is amending the Third Energy Package, reflecting the aims and targets of the Energy Union strategy on top of the energy strategies for 2020 and 2030. The package includes a proposal for a Regulation on Energy Union Governance to deliver on the Energy Union strategy's objectives and to ensure that sufficient action is taken to meet the EU's 2030 targets for climate and energy. The Clean Energy for All Europeans, more familiarly Clean Energy Package or Winter Package as from its working name, consists of eight energy legislation proposals, making it the biggest European energy-related legislative package so far (European Commission, 2017d). The four regulations and four directives, as seen in table 2, aim to find common European solutions for the energy transition and to put the consumers in the spotlight.

Table 2. The Clean Energy Package regulation and directive proposals introduced by the Commission (Based on European Commission, 2017e).

4 regulation proposals	Regulation on the internal market for electricity
	Regulation establishing a European Union Agency for the Cooperation of Energy Regulators
	Regulation on risk-preparedness in the electricity sector and repealing Directive
	Regulation on the Governance of the Energy Union
4 directive proposals	Directive on common rules for the internal market in electricity
	Directive on energy efficiency
	Directive on the energy performance of buildings
	Directive on the promotion of the use of energy from renewable sources

In addition to the regulations and directives, the Clean Energy Package also provides rules concerning eco-design, mobility, actions to accelerate clean energy innovation and renovation of the buildings, as well as measures to encourage public and private investment, promote industrial competitiveness and mitigate the societal impact of the clean energy transition (European Commission, 2017e). Several new elements are introduced in the electricity legislation, such as the DSO entity, the concept of energy poverty, new market parties such as active consumers, aggregators and local energy communities, and rules and definition for energy storage.

In the press release related to the publication of the package in 2016, the Commission described the Clean Energy Package as "a package of measures to keep the European Union competitive as the clean energy transition is changing the global energy markets". The package aims at better energy efficiency, global leadership in renewable energies and consumer empowerment, all building upon the Energy Union strategy and strengthening the EU role in the competition of leading the clean energy transition (European Commission, 2016b). The Clean Energy Package is indeed so far only a package of proposals, currently going through the ordinary legislative procedure.

Where the upcoming energy strategies are unlikely to introduce major changes in the upcoming decades, the energy legislation has developed and is likely to develop significantly in the future. The development of the energy legislation depends on the direction the energy transition is taking, as well as on the monitoring of the introduced measures to reach the already set targets. New market parties or solutions need to be widely established in order to be introduced in EU legislation.

2.7 Energy legislation flowchart

The links between EU strategies, Member State strategies, EU legislation, Member State legislation and the practices at EU, regional and national level are difficult to tie. The process from strategy to implementation involves many contributing parties and several interlinked and potentially overlapping negotiation and policy making dimensions from the high-level ones to the regional ones. This chapter looks into the links and describes the high-level process from a strategy to implementation. A flowchart is introduced in figure 4 to better describe the process from EU strategy to implementation.

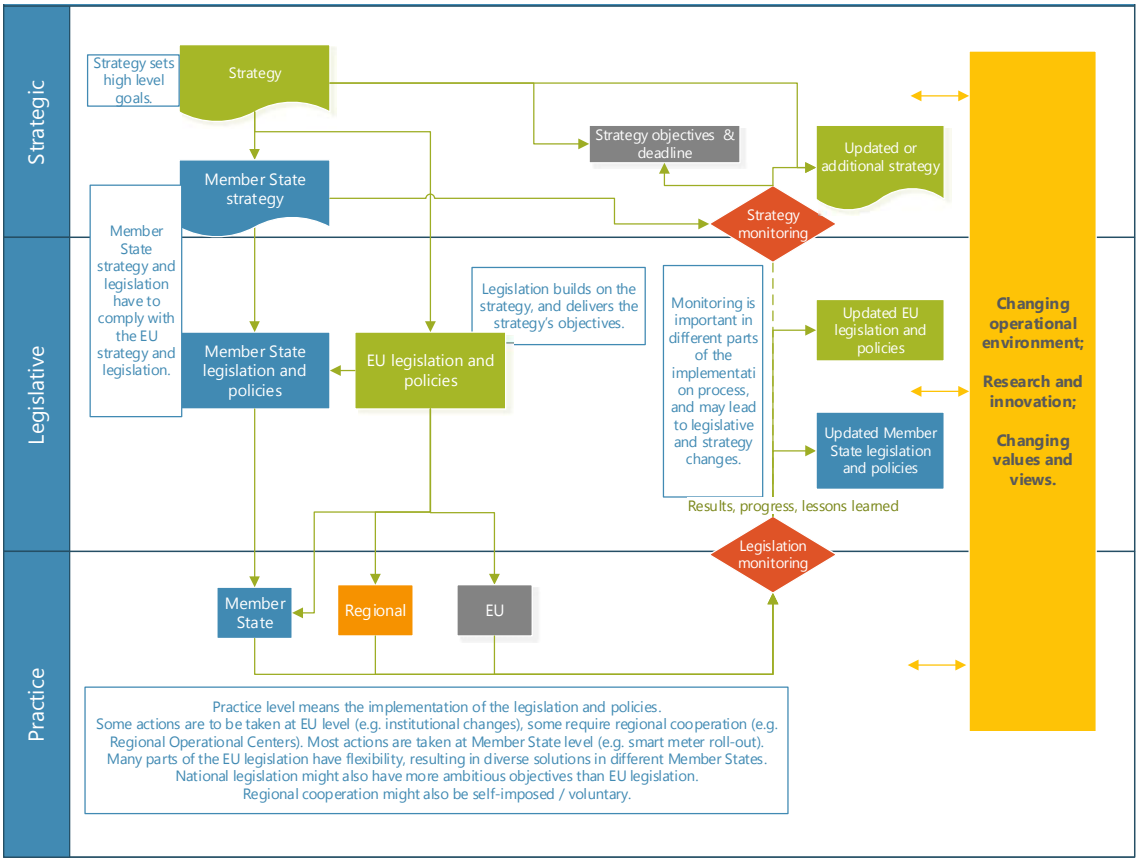


Figure 4. The process from EU Strategy to practice.

The EU strategies set high level goals and priorities, and give focus and measures for the implementation and monitoring steps. The EU strategies are used as reference frameworks for EU, regional and national activities, such as Member State strategies, EU and national legislation and EU and national standards. (European Commission, 2017g)

Legislation is a tool to implement a strategy and it provides content in the form of more or less detailed legal measures to deliver the strategy's objectives. The EU strategies and legislation overrule and influence national strategies and legislation, and the Member States need to update their strategies and legislation wherever necessary.

The practice level means concrete actions and implementation of the rules. The EU and regional level implementation take into consideration the EU strategies and legislation, while the Member State implementation takes into account both EU and national strategies and legislation.

Monitoring is an important part of the process as it shows the state-of-play at each level: Member State, regional and EU level. The EU monitoring is performed by the Commission together with Eurostat, and the related reports are made public.

Monitoring takes place between the sectors, both at strategic and legislative level. The strategy monitoring is to ensure that the strategies achieve their objectives and to see if the strategy needs to be amended, changed or terminated. The strategies are monitored through national government reports.

The EU legislation monitoring ensures that the set legislation achieves its objectives and that the Member States comply with the legislation. Based on the monitoring individual policies can be amended, changed or terminated. It also can feed in to the upcoming strategy preparation or modification. The legislation monitoring takes place through Member State internal monitoring.

In the right side of the flowchart in figure 4 there is a large box overlapping the sectors. The box indicates the impact of the changing operational environment, research and innovation and changing values and views. On one hand these factors are changing in time and give input to all the sectors, from strategy to implementation. On the other hand the process gives input to the operational environment and research and innovation and impacts the values and views.

As an example of the flowchart, the Energy Union strategy was drafted, approved and launched in 2015, building on the existing energy strategies. This strategy set a measure that the Commission would introduce an update to the EU energy legislation. The Member States needed to make sure their national strategies comply with the Energy Union strategy.

Once the strategy was finalised, the process moved to the next sector: legislation. In the legislative sector of the process, Commission drafted the Clean Energy Package and published its proposal in November 2016. The proposal's several legislative texts and communications started being discussed and scrutinised by to the Parliament and the EU Council in line with the ordinary legislative procedure and, in autumn 2017, is still under discussion.

When the Clean Energy Package is adopted and enters into force, at different points in time depending on the type of legislative act: regulation vs. directive, the Member States need to comply with the new legislation. The implementation period will start at EU, regional and national levels, as described in the practice sector.

For the Energy Union strategy, the monitoring has been done yearly and the results so far are documented in reports as follows (European Commission, 2017d):

- First State of the Energy Union, report out in November 2015
- One year of the Energy Union, progress report out in February 2016
- Second State of the Energy Union, report out in February 2017

The monitoring will continue through the implementation period of the strategy. The monitoring of Clean Energy Package will start after the entry into force, from the implementation of the adopted EU legislation.

2.8 Influencing energy strategy, law and standard preparation processes in the EU

Influencing EU processes and legislation takes place within the framework of the European Transparency Initiative. This includes a transparency register for organisations and self-employed individuals engaged in EU policy-making and policy implementation, as well as a framework for relations with interest representatives.(European Commission, 2008)

The influencing, also known as lobbying, public affairs or advocacy, is an important element in the EU processes in energy or any other sector, guaranteeing the stakeholder interest representation and helping in filling eventual knowledge gaps on very technical files. If well executed, the influencing scheme can increase the system cost-efficiency, security and balance, technology-unbiased models and concepts, industry and customer satisfaction. It can also help the strategies and legislation achieve its targets and better facilitate innovation and development. On the other hand, unbalanced influencing scheme can risk everything mentioned above.

The influencing is in some parts included in the adoption processes through the entities and institutions established (for example ENTSO-E or ACER mandates). Each institution involved in the ordinary legislative process also represents different interests and negotiate on behalf of those. A big role still remains on the associations and representation offices. Especially in a sector like energy where technical knowledge of the functioning of the gas and electricity market is needed to produce effective legislation, the role of trade associations, national representation offices, industrial actors and entities representing specific technologies is the key.

Influencing is effective if the key players within the institutions and the window for opportunities to get the messages through are recognised. This chapter focuses on those influencing points instead of concrete means of influencing. The focus is on the energy sector and, for the legislative part, in ordinary legislative procedure.

For this chapter, the figure 4 from chapter 2.7 is simplified and presented as a cycle in order to see the sector relations clearer. The EU strategy to practice cycle is presented in figure 5.

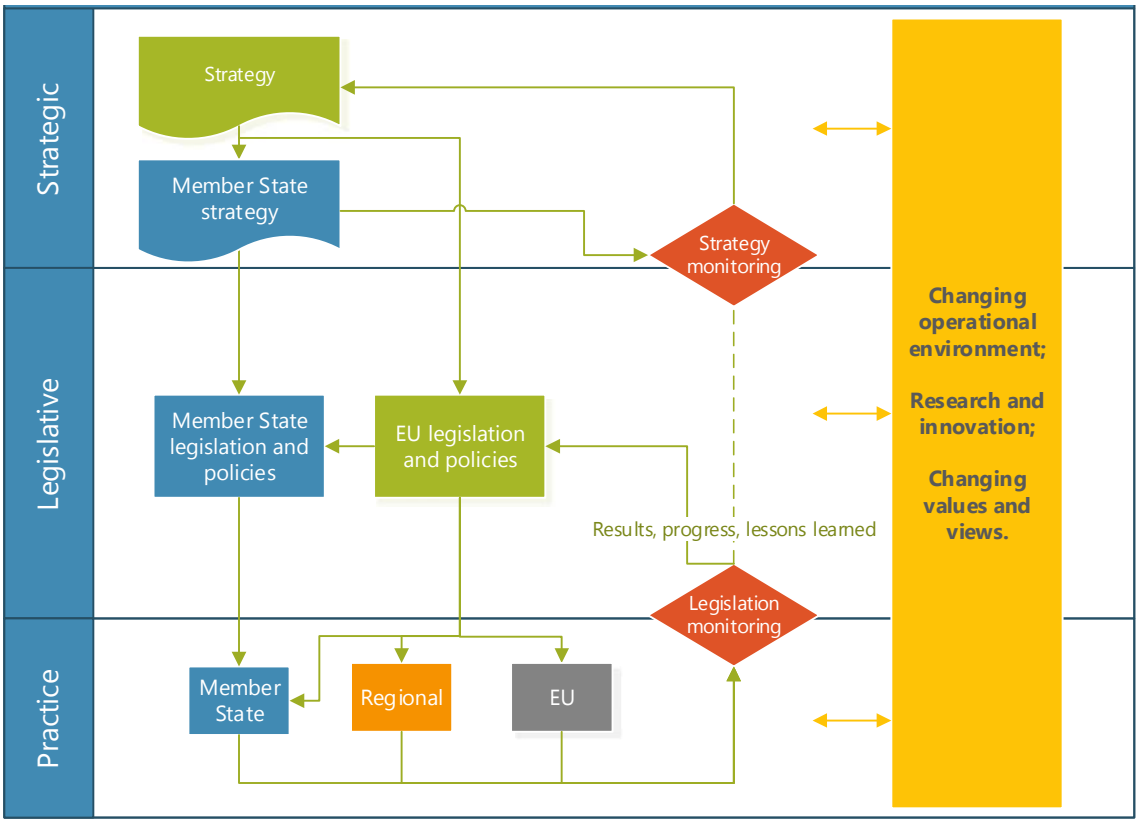


Figure 5. The strategy to practice cycle.

On one hand the influencing should be reviewed separately for the sectors of figure 5 as they are separate parts of the process. On the other hand all the sections are interlinked, and also the influencing within one section impacts another. As the strategy sets the framework for legislation, it has a big impact on the legislation structure and focus points. However, the high level strategy rarely has a specific impact on legislative details, which are specified within the legislative sector. The legislative sector has a direct impact on the practice but also the other way around: the practice sets another framework for the legislation with existing practices, technologies, network and technology capabilities and costs. Of these, the actors who aim at influencing the legislative process are better aware of. After implementation the practice shows what works and what doesn't, and through the monitoring the results impact both strategy's high level goals and legislation's details.

The figure 5 can be specified with another, more general figure. The policy cycle, as in figure 6 takes the perspective from the legislation to one single policy.

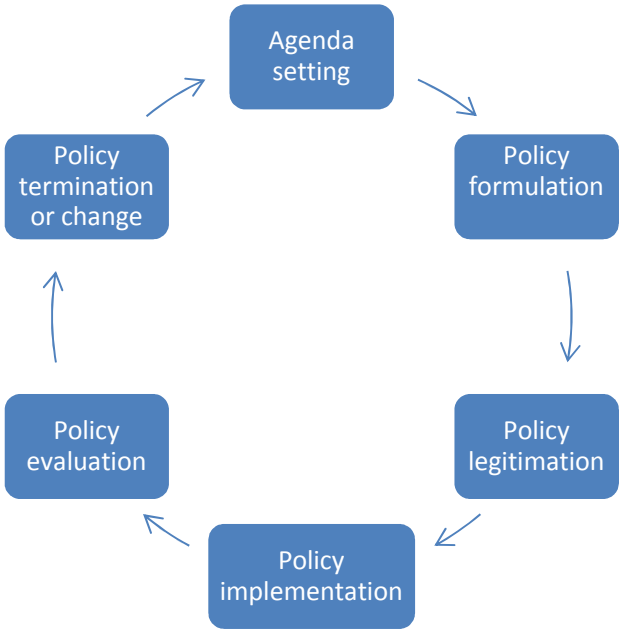


Figure 6. Policy cycle (Based on Fischer, Miller, & Sidney, 2007).

The policy cycle shows how the policy passes through the flowchart. Starting from the agenda setting, the strategy and the factors of other influence set the framework for the policy, just as shown in figure 5. The policy is formulated in this framework and goes through the adoption process, through ordinary legislative procedure. This part of the process is the legislative sector in figure 5. The 'Policy implementation' is as shown in practice sector of figure 5, and 'evaluation' and 'termination or change' refer to the monitoring and resulting changes of the same figure.

Taking a look deeper into one sector at a time, the influence points and targets can be seen clearer. Figure 7 describes in short the key players as well as the influence possibilities for each part and sector at EU level. For this figure, the strategy to practice elements have been moved to the left side of the figure. Next to them, the key players for the part of the process have been introduced, together with a short description of what is under influence in that particular part of the process. On the right side there are the operational environment, research and innovation, values and views together with a description on what from their part can influence the different parts of the process.

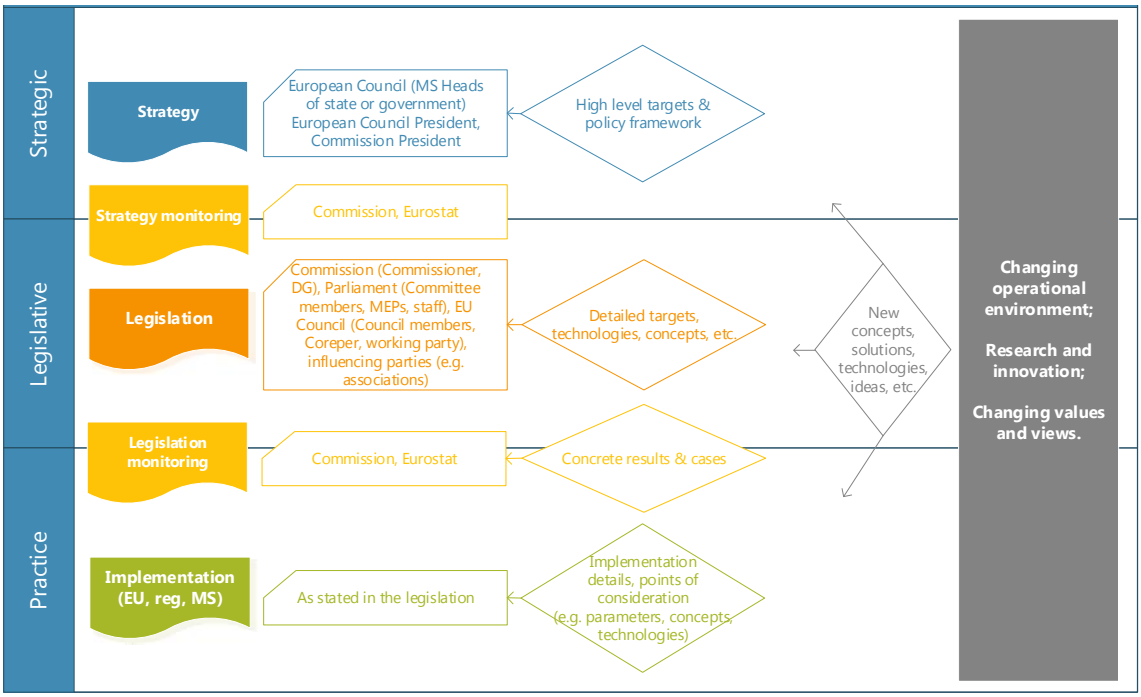


Figure 7. The strategy to practice process from influencing point of view. Key players and what is under influence.

The strategy builds on a long term framework which has been developed, modified and amended during the recent decades. The elected European Council and Parliament presidents together with the European Council members prepare a strategy for their representation period. As in figure 5, the strategy is impacted by the strategy and legislation monitoring as well as the changing operational environment, research and innovation and the changing values and views. Consistent communication and emphasizing the most important development points at both national and EU level are in long term the best ways to give direction to the upcoming energy strategies.

The easiest to influence is the legislative sector, especially the adoption process (ordinary legislative procedure). The reasons behind are especially the transparency and the level of detail and substance in discussions. The ordinary legislative procedure as described in chapter 2.4.1, if given more detail on the parties involved, can help to detect the key influencing points and targets.

The draft legislation is prepared by the Commission, and the 28 Commissioners adopt Commission's proposals either in writing or orally. In case of energy legislation and policy, the drafting usually takes place in DG ENER. The officials get political guidance from the relevant Commissioner and consult relevant parties, such as ministries, organisations or authorities. The proposal is consulted on and discussed with the other DGs, amended where necessary and taken to a meeting of heads of cabinet to be finalised and prepared for the decision of the college. (A.K. Itkonen, 9.10.2017)

Although the Commission has no formal say in the Parliament and the EU Council votes and decisions, it provides opinions throughout the procedure and can impact the votes needed. They also play a role in finding agreements between the Parliament and the EU Council, presenting opinions within their internal meetings and attending the trilogues and tripartite meetings. It should also be noted that the Commission has the power to withdraw or amend their proposal during the first reading period.

In the Parliament, the legislation proposals are discussed at committee level, as identified by the President with the support of technical services. Each piece of legislation or each topic under scrutiny gets a rapporteur responsible for it, and shadow rapporteurs from other political groups who negotiate the topic with the rapporteur. A coordinator is set for each committee from each political group when the new Parliament starts working after the European elections. The coordinator is responsible for coordinating the outcomes and making sure that they are in line with each other with the help of the rapporteurs and the shadow rapporteurs. Having this role, the coordinators are in a powerful position in the committees. Political groups also have Secretariat staff, EU officials who are in charge of the committees. They have important roles in the shadow meetings and in formulating the compromise amendments.

In the committees, the first touch to the Commission's proposed legislation might not be by MEPs but by their team, i.e. a political assistant working directly with the MEP and specialised in energy matters and/or a political group advisor.

The leading committee needs to take into consideration if another committee is offered and wants to have a say on the proposal, as often a part of the legislation may have an impact on the work area of another committee. At this point, there are the leading committee and the associated committee(s) working on the same topic, separately but in cooperation with each other. Depending on the nature of the topic, associated committee can have a consultative role and issue an opinion, or also produce dedicated reports that need to be voted on.

The committees follow the process shown in figure 8 for each piece of legislation or topic, in the lead of the rapporteur. The timeline of the work process is coordinated in and by the committees involved, the schedule varying for each topic or piece of legislation. Only in the second and third reading there is a time limit set by the ordinary legislative procedure.

Figure 8. Parliament's committees' work process for each piece of legislation.

After the process within the committee, if the leading committee's vote is positive and the proposal is adopted, the proposal is placed on the plenary agenda. In the committee

stage, amendments can be tabled by any MEP but in plenary they must be tabled by the committee responsible, a political group or at least 40 MEPs before the plenary vote. The Commission comments on all the tabled amendments (European Parliament, 2016b). The political groups guide the MEP votes.

If the second reading is taking place, the time limit guides the Parliament process, the leading committee works without the associated committees and the proposal under discussion is the EU Council's proposal. In case of a third reading, the final proposal is only debated and voted by the plenary.

In the interest of time and since the entry into force of the Lisbon Treaty that made the ordinary legislative process as the standardised law-making option, the three institutions involved try to finalise the text after the first reading and avoid going through a second or third.

Within the EU Council, the legislation proposal passes through three levels, which are (EU, 2017c):

- Working party,
- Permanent Representatives Committee, also called Coreper, and
- Council configuration.

The three levels ensure the technical scrutiny at working party level, the political responsibility by EU Council configuration and the combination of the technical and political aspects by the Coreper. (EU, 2017c)

The working parties prepare the EU Council's positions and decisions. The working party consist of the Member State representatives and are chaired by the representative of the country holding the rotating Presidency. The working parties report to the Coreper covering the topic of reference and the Coreper prepares the ministerial level decisions of the EU Council. The EU Council only finalises its position after the Parliament's first reading amendments and the Commission's resulting amended proposal. (European Parliament, 2016b)

The second Council reading goes through the same structure as in the first round, the time limit guiding the process. In the third reading only a vote takes place.

Conciliation, before the third reading, involves both Parliament and EU Council representatives. The Conciliation Committee is convened by the President of the EU Council with the agreement of the President of the Parliament. The EU Council's representatives come from each Member State.

The first reading's trilogues, if arranged, are attended by the rapporteur, the shadow rapporteurs (political group advisors and/or Parliament Secretariat staff) where appropriate, the EU Council's chair of the working party and/or Coreper, the Commission

department responsible for the dossier and the Commission's Secretariat-General. Usually, but not necessarily the representatives of second reading informal meetings include the rapporteur, shadow rapporteurs, the chair of the EU Council working party assisted by the Council administration. The Commission, if attending, is usually represented by the officials in charge, the Commission's Secretariat-General and Legal Service.

The figure 9 summarises everything mentioned above, amending the ordinary legislative procedure with key decision makers, influencers and a short description of influencing opportunities. In the figure the weight of the vote taken in the different steps of the procedure can be seen from the green and red boxes indicating the opportunities for the procedure to end to adoption or termination. The numbers of the steps in the figure are as in figure 1 which described the ordinary legislative procedure.

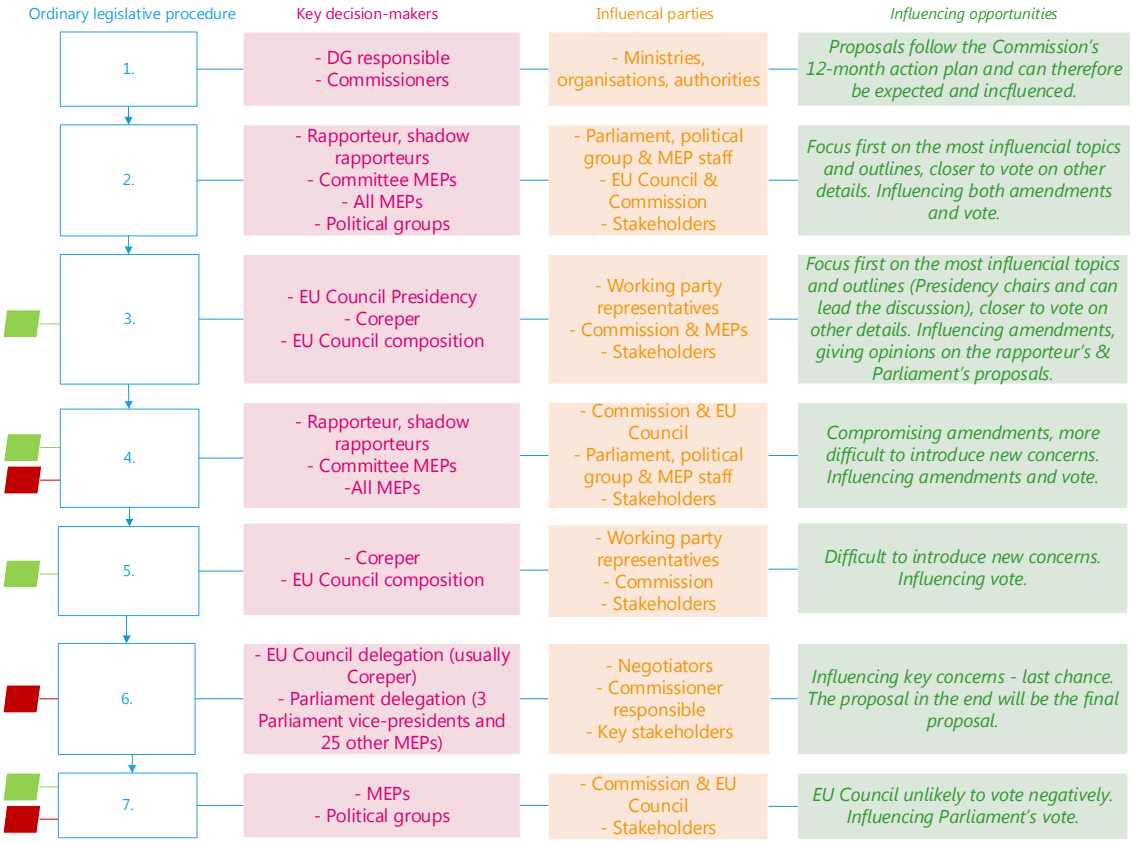


Figure 9. Key decision makers, influencers and influencing opportunities in the ordinary legislative procedure.

In general, transparent processes are the key in enabling influencing. The processes of the Parliament are mostly public and the MEPs, documents and meetings are quite easy to access. The documents and meetings of the EU Council are not as easily accessible and therefore straight national government contacts become more necessary. Trilogues and second reading informal meetings are difficult influencing points due to their informality.

For legislative packages the best stakeholder influence period could be considered during the drafting and the first reading period. Later in the procedure the focus is more in

compromises on already taken positions, and additional comments or suggestions might be hard to get through.

When proceeding in the strategy-to-implementation cycle to EU, regional or national implementation, there is no set structure on the process. The details are specified in the set legislation and the influencing framework therefore dependent on the previous steps. Also the key players in the implementation phase vary. The implementation can be led by the EU, regional or national institutions or it can be a cooperation of different players. The monitoring responsibility stays with the Commission, but there is little to influence in the monitoring phase from stakeholder point of view as the monitoring often builds on statistics. Altogether, this results in a case-by-case evaluation need of the influencing points.

Taking a brief look at the standardisation, the influencing during the process takes place mostly through national standardisation bodies which vary in structure from nation to nation. Direct, topic focused influencing can take place by taking part through a national standardisation body or in some cases through an association in the working groups or technical committees within EU standardisation bodies. The stakeholders also can point out a standardisation need. In ETSI differs industry can be directly involved in the standardisation processes where they see a need to impact.

The EU influencing framework is the combination of everything mentioned in this chapter. To be able to find the right influencing points one must know in which stage the process is, what are the relevant proposals and who are the parties responsible (e.g. committee involved, rapporteur and shadow rapporteurs).

The influence-maker is most typically an association or an organisation due to wider resources, but it can also be a company or an individual. With limited resources the easiest approach could be through consultations and workshops whereas the wider resources enable a more active approach targeting specific meetings or individual decision-makers, also allowing further influencing channels such as position papers, infographics or the use of social media. As influencers, the mandated EU entities, ENTSOs and ACER, have a strong voice in the preparation and the adoption processes of the legislation.

3. ELECTRICITY SECTOR UNDER ENERGY TRANSITION

The energy transition doesn't only concern the electricity sector, but also for example gas, heating and cooling, building and transportation sectors. This chapter focuses on the transition of the electricity sector.

The energy transition is used to describe the change we are making from the system that was first established towards a system with more automation, options and flexibility, with more active market and market players – including the customers – and towards less-pollutive options in all sectors that deal with energy. It is not possible to point to an exact time when the transition started. Neither is it possible to state when the transition will be over or to comprehensively list what it includes. The system and industry are shaping themselves in the transition process. Depending on many factors from innovation to world politics, any technology, model, solution or something else might change the direction of the energy transition.

The chapter first shortly describes the electricity system as it was established and as it remained until almost the 21st century. In chapter 3.2 the more recent developments and the system of today are described.

3.1 The European electricity system of the past

Taking a look back, before the internal electricity market target the European energy system was made of local monopolies, the local electricity companies often consisting of energy production, sales and distribution departments. The customer had a connection to the network and paid a tariff to one and same company for both network and the supply.

The generation plants were mainly quite large, and the system worked with a top-to-bottom model, with unidirectional flows from higher voltage level to lower. This unidirectional electricity system is demonstrated in figure 9.

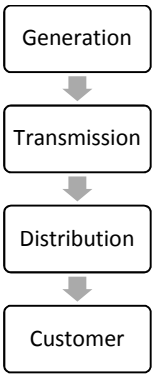


Figure 10. Traditional unidirectional electricity system.

In the traditional model, demand led the supply, the supply being adjusted to the demand with the help of customer profiles and real-time adjustments. The transmission system operators were looking over the overall security of supply and system balance and the balance responsible parties consisted mainly of the local electricity companies and some large-scale producers.

3.2 The European electricity system today and in the near future

During the decades there has been a massive development in technologies, communication and IT tools, in materials and methods, even business models. Some solutions have found their way to the market, many more are in research, and new solutions and tools arrive all the time.

The market has been liberated, with the aim to deliver more competition and more efficient and cheaper energy as well as to empower the customer. The unbundling has resulted in separate DSO and supplier roles, the DSOs working as neutral market facilitators. The role separation has provided the way for new market actors but also new solutions such as aggregation.

The research and development of the energy sector is both natural and boosted through the EU, regional and national frameworks. The climate change and running out of natural resources, oil, natural gas and coal, is better understood resulting in sustainable solutions' research and establishment. At the same time the emissions and the need of energy are only increasing.

In addition to renewable energy, the role of energy efficient solutions and circulation economy are more acknowledged. The energy cycle is reviewed from the beginning (resource) to the end (waste), and at the same time the discussions are moving from reducing the consumption towards adjusting the consumption – or as even better described, optimising the energy use.

The transition started latest with smart solutions that were enabled by better ICT systems and grid automation. The smart grids improved the electricity system in a short period of time in terms of faster and more direct operation and communication, better and more detailed operational and planning information and more cost-efficient processes. More was to follow with smart meters gaining popularity also at low voltage levels, customer smart phone applications improving the service, improved cyber security solutions, residential automation, etc.

The energy system of today has large amounts of local and distributed generation and small generation units connected in different points of the distribution network with or without storage facilities. Increasing amount of small industries and household customers has installed solar panels and with the increasing use of smart meters they are becoming more active participants in the electricity system (EUR-Lex, 2017a). As a result of the generation change together with further use of flexibility, low voltage networks are now used as carriers of bi-directional electricity flows. (Eid, Codani, Perez, Reneses, & Hakvoort, 2016)

The role of environment and climate policies has been major and different EU and national subsidies have emerged to boost the transition and industry. The subsidies have helped in reaching the targets set in the strategies and in making business cases where the market has been small or not existing. As subsidies also result in market distortions, they need to be reviewed and in long term replaced by new, more suitable policies.

With the changes coming with the energy transition, the electricity system investment costs are temporarily high. However, the boosted transition provides the EU and its citizens with a more sustainable system as well as with short term benefits through employment and life-quality. (Eid et al., 2016)

3.2.1 Smart meter roll-out

Automatic meter reading (AMR) can be defined as a form of Advanced Metering that uses communication devices to communicate data from the meter to the utility or to a meter data management. AMI refers to automated or advanced metering infrastructure, utility infrastructure with two-way communications for metering and associated systems allowing delivery of a wide variety of services and applications to the utility and customer (EURELECTRIC, 2016c). Smart meter on the other hand refers to the metering device installed to the consumption or generation point in the network. An installed smart meter doesn't automatically mean that AMR is in use as the whole infrastructure, AMI, needs to be in place.

AMR may be used to transmit consumption data or more complex measures of energy. The system operator can also utilise the meter for outage detection, and the meter can be

remotely programmed (EURELECTRIC, 2016c). The data can be shared by the metering responsible party to the supplier or other relevant parties where necessary.

Smart meters are replacing slowly but steadily the manual meters, and AMR the manual meter reading (MMR), all across the EU. MMR only needs a meter measuring the consumption of the consumer. The consumption is usually first estimated based on the customer size and type, which gives a basis to the electricity bill of the customer. After the meter is read in the location, typically once a year, the real consumption is compared to the estimation. The customer will then either be charged or compensated on the electricity bill, depending on if the estimation was more or less than the real consumption.

Comparing manual and automatic meter reading, AMR offers many new benefits: the automated processes, accurate and close-to-real-time data, customized billing dates and actual billing data, new products and services, consumption signals, intelligent business planning, etc. The AMR also introduces some new risks, such as cyber security threats. The customer information confidentiality and customer freedom need to be carefully ensured when using smart meters.

The functions of the smart meter have been up to each Member State to decide and the EU's set installation obligations regarding AMI very limited, emphasizing the role of national decisions and targets. The percentage of smart meters installed in different MS is currently between 0 % and close to 100 % of the consumers connected to distribution network. There are also different approaches for the communication system and data management.

Commission report in 2014 on smart metering deployment found that in the EU, with the Third Energy Package legislation, close to 200 million smart meters for electricity would be rolled out by 2020, meaning that 72 % of European consumers would have a smart meter. (European Commission, 2014b)

3.2.2 More local and distributed energy

Following the energy strategies, the EU electricity system has more recently been aiming for higher shares of renewable energy resources: solar, wind, hydro, geothermal, waste, biofuels, biogas, and tidal power. For the monitoring of the Energy 2020 strategy targets, Eurostat has published a graph which showcases the increase in the renewable energy use in EU. The graph is presented in figure 9.

Although from the graph it can be seen that almost all of the renewable energy resources are more used in 2015 than in 1990, the public discussions in many cases focus on the solar and wind power due to their breakthrough in the 21st century and expected growth in popularity in the future. The hydro and geothermal energy are mostly in use where possible and there is little possibility for development. The tidal power men-

tioned above is not in the graph as its percentage of the produced energy is, at least currently, so low.

The self-providing small industries and prosumers, customers who also produce, have grown in number especially in the middle and southern part of the Europe but also elsewhere. They mainly produce energy through solar photovoltaic (pv) panels on their rooftops, citizen-led energy cooperatives or housing associations. Otherwise, also public institutions like schools or hospitals are nowadays often installing generation capacity. Policies and developing technologies have lowered the cost of renewable energy technologies, especially solar panels. In some Member States prosumers already produce electricity that costs the same or less than the electricity from the grid, even when all costs incurred over their lifetime are taken into account. This development is even further increasing the popularity of the pv investments. (European Parliament, 2016a)

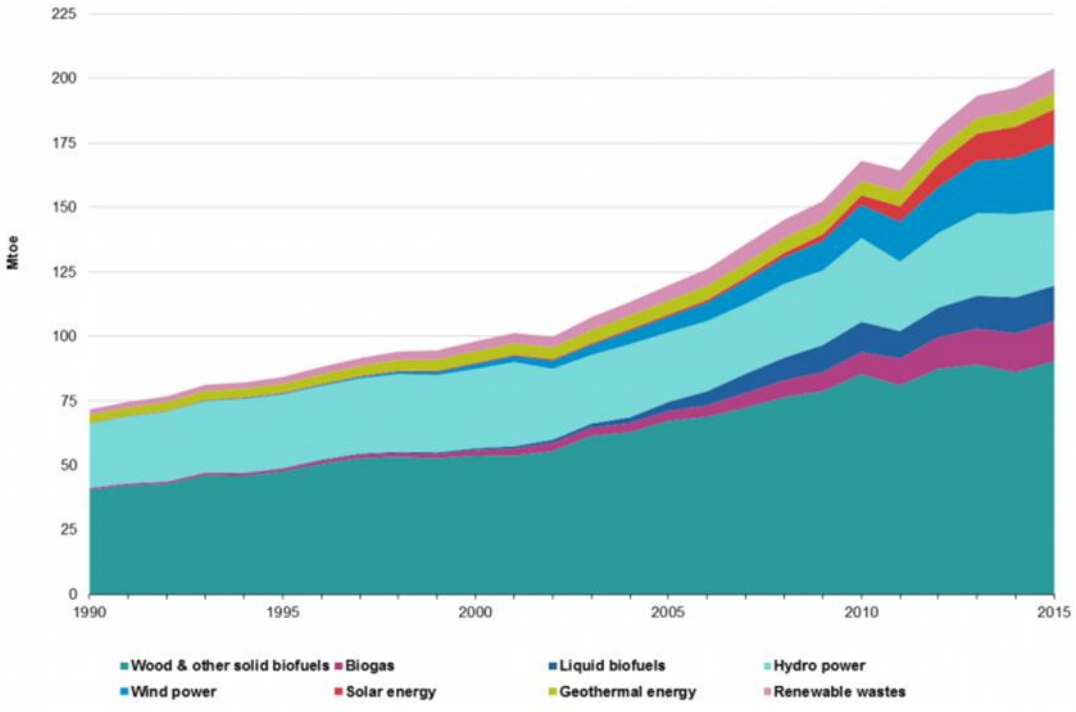


Figure 11. Primary production of energy from renewable sources between 1990 and 2015. (Eurostat, 2017c)

With an increasing share of renewables there is a lower predictability in the supply and demand. The low predictability increases the need for different kinds of flexibility services to cope with the volatility. The system needs flexibility for ancillary services, balancing, network constraint and capacity planning and in long term in spot market energy trading and generation capacity planning. Potential flexibility providers are for example EVs, different types of loads, electrical heating, storage or combined heat and power units. (Eid et al., 2016)

3.2.3 Active customer

When the Clean Energy Package was presented by Commission in late 2016, they used the headline "Commission proposes new rules for consumer centred clean energy transition". The customer has moved to the centre of the system, and the potential of customer participation is now considered higher than ever. The words active and customer are paired to indicate this participation in system by providing energy, flexibility or control. As the market is becoming more unpredictable, active customers and customer involvement enable new market solutions to tackle the volatility and to offer flexibility in the modern system.

The active customer is defined at EU level for the first time in the Clean Energy package. Active customer is a customer or a group of jointly acting customers who consume, store or sell electricity generated on their premises, including through aggregators, or participate in demand response or energy efficiency schemes provided that these activities do not constitute their primary commercial or professional activity (European Commission, 2017e). Active customers are therefore customers who take active decisions on their consumption, production or energy-related services.

To clarify the potential of active customers from both customer and network perspective, table 3 summarises the system potential, offerings and opportunities for regular consumers in comparison to active customers. In this context, the regular consumer refers to someone who utilises the grid for every-day living or operation but has no further interest or intention to take further role in the system.

Table 3. The system potentials and offerings for a consumer and an active customer.

Type:	**Potential:**	**Offerings:**
Consumer	Reducing consumption	Data (smart meters: more accurate data, remote system control)
		Information (outage durations, billing, etc.)
	Limited decision-making / control	Opportunity to choose electricity provider
Active customer	Smart consumption	Data (smart meters: bidirectional flows, more accurate data, remote system control)
		Information (outage durations, billing, etc.)
	Smart production Strong decision-making / control	Self-consumption, selling excess electricity (to utility, peer-to-peer)
		Demand response & flexibility services, increased potential with the use of storage & EVs
		Opportunities to choose electricity provider, to take part in an energy community, to impact service offerings, etc.
	Co-development	Co-development to improve solutions and offerings

The overall awareness of consumers has increased. When in the past a general household customer barely knew about the utilities, energy distribution or electricity market – or about one's consumption or what it consists of – the role of the customer as a part of the network is now stronger and more active than ever. As explained in the table 3, even as a regular consumer the potential and, to some extent, possibilities to make active decisions have increased. Even if the customer is not well aware of the industry or the electricity system, with smart meters they can receive more detailed data of their consumption helping them understand their energy use and reduce their consumption. Another way to have control is through energy contracts: the customer has a say on the provider and can influence the energy mix.

The active customer has a wider role in the system. On top of all the above mentioned they can participate with self-production or with demand response or controlled self-production. They can also control their excess electricity: to inject to grid, to store or to do peer-to-peer trading. To do all of this they might also choose to join a virtual power plant provided by an aggregator. There is further potential and more options when it comes to flexibility offerings if the customer utilises storage or EVs. The customer, in order to be active, doesn't need to be well aware of the technicalities of the network, as they can be active through contracts and automation.

A prosumer is a type of an active customer, self-generating electricity for their own use. The Clean energy package doesn't define prosumers separately but mentions the need for a legislative framework in order to guarantee the consumers' rights to generate energy for their own consumption and sell surplus into the grid. (European Commission, 2017k)

3.2.4 More interconnected and regionally operated EU network

Although the national TSOs are traditionally responsible for the electricity system as a whole – the balance and security of the system – there are recent initiatives to amend the current practise. These intentions aim to increase the cooperation within and between the regions and to increase the number of interconnections between the Member States.

The EU's aim to create a European internal energy market means more interconnected and coupled wholesale markets. This leads to a need to maximise the cross-border transmission capacity in order to ensure the efficient dispatching of units. As a consequence, a regional approach for the transmission system operation is required. Another need for regional system and its coordination comes from the integration of distributed renewable generation increasing the system volatility, not forgetting that the regional approach could help to reduce carbon emissions in a cost-efficient manner and to guarantee the regional system security.

The establishment of ENTSO-E was a clear EU mandate for further cooperation of national TSOs at EU level. With the developed network codes and guidelines rules for the internal energy market have been established, including a formal concept of regional security coordination within System Operation Guideline. The System Operation Guideline entered into force in autumn 2017.

The regional security coordinators (RSCs) are entities created by TSOs within a region, which assist them in maintaining the operational security of the system. In the late 2017 there are already four established RSCs, three of which are in operation. To be exact, the first RSCs were already set up in 2008 on a voluntary basis. (ENTSO-E, 2015b)

All RSCs should be established by the end of 2018. Prior to the adoption and entry into force of System Operation Guideline, European TSOs and ENTSO-E signed a Multilateral Agreement on Participation in RSCs, which requires the TSOs to participate in RSCs or to contract the five essential services from them. (ENTSO-E, 2015b)

The five RSC services include (ENTSO-E, 2015b):

- Operational planning security analysis,
- Outage planning coordination,
- Coordinated capacity calculation,
- Short and very short term adequacy forecasts and
- Common Grid Model.

Although the concept of RSCs is already formalised in EU law with the System Operation Guideline, the Commission, in Clean Energy Package proposal, went further. The Commission showed ambition to give a larger role to regional security coordination, giving RSCs, or as they renamed them Regional Operational Centres (ROCs), further operational roles and responsibilities. (European Commission, 2017e)

Although the Commission's proposal for ROCs would not remain in the Clean Energy Package as intended, the proposal already shows some indication of the EU's aim for further integration of the system.

3.2.5 The EU electricity legislation in the energy transition

The energy transition is pushing the electricity legislation developments at national and EU level. The Clean Energy Package introduced rules and responsibilities to an increasing extent in distribution level. New widely emerging market parties such as aggregators, electric vehicles and storage facilities are for the first time taken into consideration in the EU energy legislation. The emphasis is also given to residential customers and electricity pricing which are in the middle of the traditional and emerging electricity systems.

With Clean Energy Package the Commission proposed consumer-centric legislation. The consumers are seen as the drivers of the transition through the introduced technologies (European Commission, 2016a). The solutions need to be described in legislation in order to promote the new technologies and their role in the market but also to give all the EU citizens the same opportunities to take part in the market and to impact their electricity bill.

The pressure and push to introduce the solutions in legislation emerges when the solutions fall in-between the set roles and responsibilities. The risk is that the restrictions or rights set in the legislation don't apply and market distortions are created. The national legislation can solve the distortions in local market but if all the Member States set their own rules, the target of European internal market is difficult to reach. Common rules and responsibilities can create a competitive European market and help with overall cost-efficiency. The EU has the challenge of fitting new legislation to the already set national rules and responsibilities. They also need to be careful not to block future innovations or new uses of the technologies.

4. NETWORK TARIFFS

To showcase and better describe the energy legislative processes and the energy legislation changes in the transition towards a model with active customers, emerging new technologies and new offers and services, the chapters 4 and 5 describe the distribution network domestic customer tariffs in the energy legislation and energy transition. The network tariffs are one of the developing policies in the middle of the transition.

This chapter first gives a general overview on the electricity pricing in order to give a view on the electricity bill and the network tariffs' part of the bill. After that, the focus is on the network tariffs – on objectives, tariff components and pricing methodologies.

4.1 Electricity pricing

This chapter discusses the electricity pricing. The components for electricity pricing are (EURELECTRIC, 2017b):

- the price for electricity trade and sales, production and customer service,
- the price for electricity transmission and distribution, construction and maintenance of the power grids,
- the policy costs and taxes, such as renewables support and value added tax (VAT).

On top of the above mentioned, for some large customers there might be other costs, for example depending on the share of real and reactive power used and generated.

In the EU, the electricity prices vary a lot from country to country due to demand and supply. Also within a country, the percentages vary depending on customer type and contract. The change factors for national differences include the energy mix, interconnections, the local network and its cost, national policy costs, weather conditions and the level of excise and taxation. (Eurostat, 2017b)

The average percentages presented in this chapter are counted for two different cases: the average for Member State and the average for EU citizen. In both cases the equation in use is:

$$\frac{\sum(y * x(y))}{\sum y} \qquad (1)$$

The x represents the percentage of the variable – for example the share of the network charge or taxes. In the case of Member State average, *y* represents a Member State and therefore has the quantity of 1. In the case of EU citizen average, *y* represents the num-

ber of citizens in each Member State. The difference between the averages is that in the EU citizen average the larger Member State pricing policies are emphasized.

The average household customer with a consumption of 2500-5000 kWh payed 0,205 €/kWh for electricity in the latter half of 2016 in the EU. The highest price was measured in Denmark (i.e. 0,308 €/kWh), the lowest in Bulgaria (i.e. 0,094 €/kWh). This makes the total price of electricity for households in Denmark over 3 times higher than in Bulgaria (Eurostat, 2017b). The electricity prices in all EU Member States are shown in figure 12. In the figure, the price of the energy and supply, the network charge and the taxes and levies are separated to indicate the differences between the Member State component shares.

The electricity prices country by country, as in figure 12, can also be seen in annex 1 with exact values. It is good to notice that in the annex, the European countries that are not EU Member States are shown in the contents, but they are not considered in the minimum, maximum or average values as they are not bound by the EU energy legislation and therefore are not totally comparable.

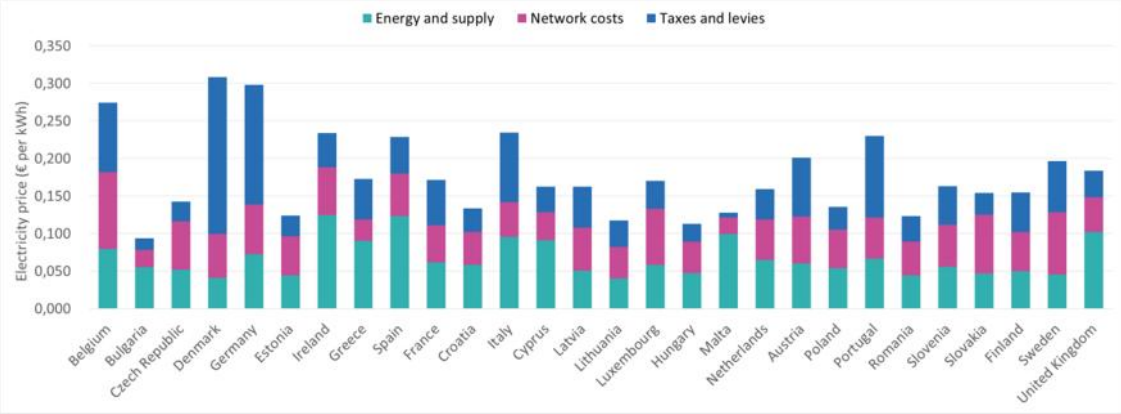
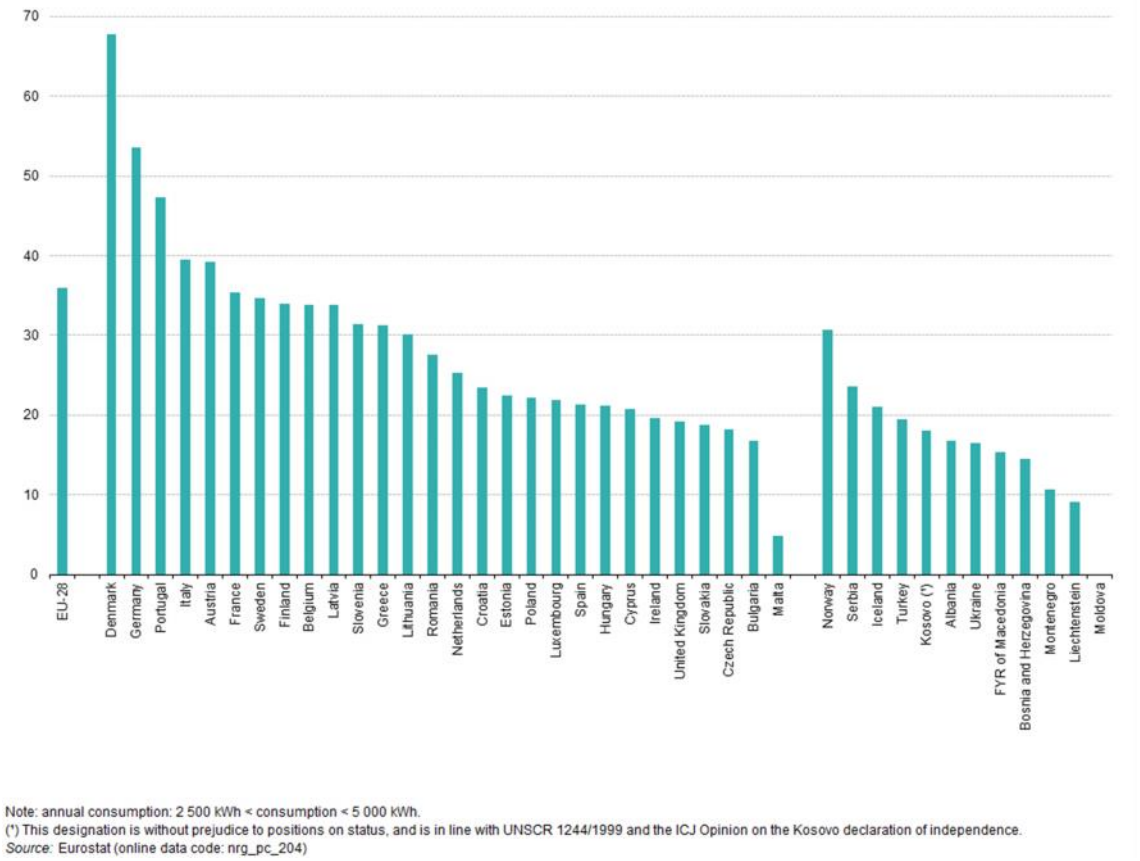


Figure 12. The total electricity price paid by domestic customers (2500-5000 kWh consumption) split into price components, second half of 2016. Based on (Eurostat, 2017b).

The figure 13 shows the range in the share of taxes and levies (% of electricity price, in average) paid by household consumers with a consumption of 2500-5000 kWh in the second half of 2016 in the EU Member States (Eurostat, 2017a). This recent overview shows a variation from 4,8 % taxes and levies in Malta to 67,8 % in Denmark, while the average percentage of taxes and levies of EU Member States is 29,1 %, as calculated in annex 1. The average EU citizen tax share is higher, even 36 %, as shown in figure 13.

The figures 12 and 13 together show quite well how big a role the taxes and policy costs play in the formation of the total electricity price. The share of taxes has become an important topic of discussion, as flexibility is gaining popularity. The reason for the current debate at both national and European level is that effective price signals need price variations, which are easily lost with high shares of taxes.



Note: annual consumption: 2 500 kWh < consumption < 5 000 kWh.
(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.
Source: Eurostat (online data code: nrg_pc_204)

Figure 13. Share of taxes and levies paid by domestic customers (2500-5000 kWh consumption), second half of 2016 (%). (Eurostat, 2017a)

The network cost component of the electricity price is typically somewhere around a third of the total electricity price for household customers. The price variation between EU Member States in the latter half of 2016, as calculated in annex 1, was between 16,5 % (Greece) and 50,8 % (Slovakia), with the average of 31,4 % in the EU Member States. Looking at all EU citizens at once, the average network cost share is a little bit lower: 28,9 %.

The annex 1 shows a variation of 13,2 % (Denmark) and 77,9 % (Malta) in the electricity sales, trade and production component in 2016, with an average of 39,4 % in the EU Member States. Again, taking into account the populations of the Member States, the sales, trade and production cost share changes to 35,1 % per EU household customer.

Figure 14 shows the average electricity price shares in the EU Member States and figure 15 the average per domestic customer, taking into account the populations of the Member States.

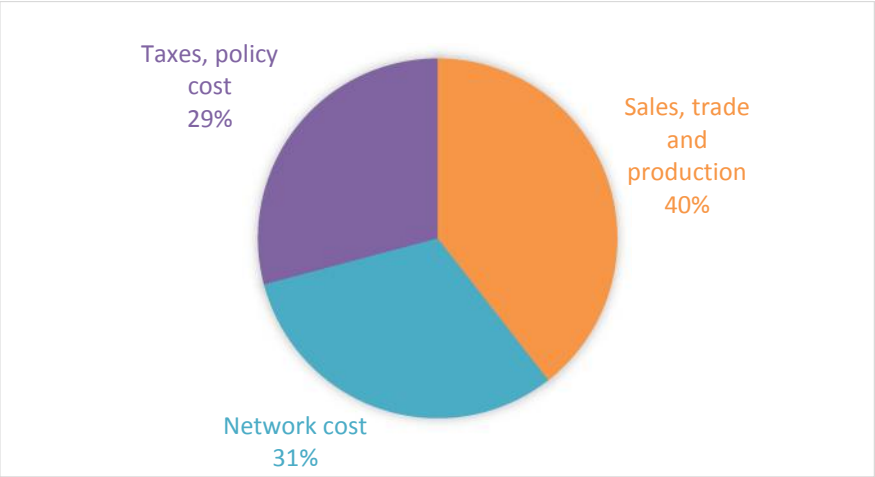


Figure 14. The EU Member States' average shares of electricity price components.

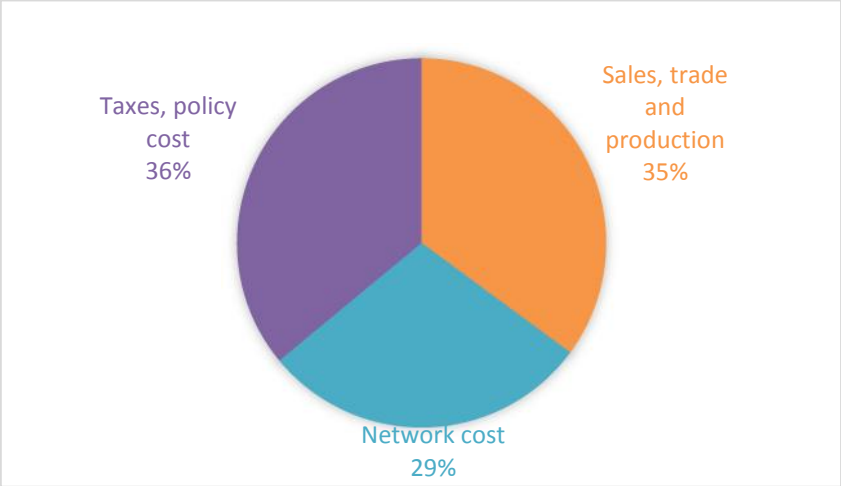


Figure 15. The EU household customers' average shares of electricity price components.

In general, the electricity price trend has been mainly growing, as can be seen from figure 16. In a European Commission study from 2014 (2014a) it was noted that the wholesale cost was going down, but the trend was not reflecting to the retail cost. The sales component share of the total cost was found to be decreasing.

When it comes to taxes, levies and policy costs, the study found that in particular the levies for financing energy and climate policies have increased significantly. Most EU Member States use the taxes and levies to finance climate policy measures and to promoting renewables and energy efficiency. (European Commission, 2014a)

Behind the total electricity price increase, there is for example the transition towards more renewable energy resources, wind and solar power in particular, which has an impact on network investments and energy production costs. Another big change is the transition from public monopolies to liberalised markets. In the market oriented ap-

proach the new energy investment costs are directed to the users instead of the taxpayers as in the public model. (European Commission, 2014a)

For the sales, trade and production component – wholesale and retail market costs – the price development was found to be also a consequence of the market competition increase, the unbundling of electricity generation from system operation, the fall in the EU ETS carbon prices and growth of power generation capacity with low operating costs, for example wind or solar power, mostly resulting of the EU energy policies. (European Commission, 2014a)

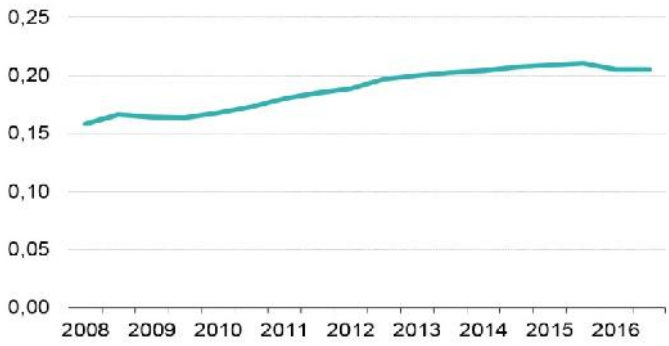


Figure 16. The average electricity price paid by domestic customers (2500-5000 kWh consumption), trend between 2008 and 2016.

The increasing electricity prices lead the way towards self-production, which causes further increase in the network cost to the customers who don't have self-production. The electricity price structure is developing as is the price itself. Reviewing network tariff structures to match the tariff objectives is one of the key challenges of electricity pricing in the energy transition.

4.2 Network tariffs

The network tariffs are collected to remunerate the system operators for the network costs, such as maintenance, investments, fault repair, service, general operation costs and the network owner returns.

The decisions concerning distribution level tariff schemes are currently made at Member State, in many Member States even at single DSO level. (European Commission, 2015, s. 146)

For the transmission and distribution network tariffs the discussion is usually quite similar, but with the difference that the distribution network is even more local, with no straight interconnections to other Member State networks, making it more a matter of subsidiarity than with transmission networks. Still, transmission network tariff schemes have so far also been a matter of Member State regulation and policy.

The monopoly of electricity distribution, as well as transmission, requires the regulators to be involved in the tariff supervision. The national regulatory authorities' role is to guarantee that the system remuneration stays moderate. This supervisory role is implemented differently from Member State to Member State.

4.2.1 Network tariff objectives

The main objectives of network tariffs are cost recovery, predictability of income, fair cost allocation and efficient use of the network, as described in the following (EURELECTRIC, 2016a). The objectives can be considered the same at different voltage levels and through the energy transition.

The objectives can be described in more detail as follows:

- **Cost recovery:** Building, replacing, fixing, taking down, securing and reinforcing the network are all necessities for being able to operate the network in a reliable and an efficient way. For the operation, there have to be personnel, tools and ICT. The objective of cost recovery indicates that the income from tariffs should be enough, but not more, than what is used for the network operation and investments.
- **Predictability of income:** Predictability of income reflects especially to the operation of the system operator. The better the income model, the easier it is to measure the tariffs to match the expenses. With good predictability of income remarkable tariff fluctuations can be avoided.
- **Fair cost allocation:** With fair cost allocation objective the system operator strives to share the remuneration costs between the diverse network customers in such a way that the tariffs reflect the real system impacts of the customers. The tariffs are also designed to reflect the link between the connection and the use of the system (EURELECTRIC, 2016a). The fair cost allocation is especially under review with emerging new market players. In a changing system the costs are easily misplaced.
- **Efficiency:** The objective of efficiency can be looked at from at least two perspectives. For customers and regulators, the regulated remuneration of DSOs guarantees the efficient and cost-efficient planning of the system. For the system operators, the network tariffs, at their best, can provide a tool for directing the customers to certain kind of behaviour, helping with system constraints and congestion management, and possibly even reducing or delaying the need for new infrastructure up to a certain point.

The policy objectives related to distribution tariffs have also been communicated in a study commissioned by DG ENER (2015). In addition to the above mentioned objectives they mention objectives for the tariffs in order to support the energy transition:

- Coordinating the distribution network development and the deployment of smart technologies with the development of distributed energy resources.

- Extracting demand-side flexibility.

Optimal tariff schemes would fulfil all of the above mentioned objectives. The task of tariff optimisation is however balancing between the different system users' needs and the system needs – and due to differences in customers, networks and operation areas, what works for one DSO or one Member State, might not work for the other.

4.2.2 Network tariff components and pricing methodologies

As the chapter 4.1 described, network tariffs make around a third of the electricity bill. However, there is no one way to count the price for the use of the network. There are three different components in use, and many ways to specify their emphasis. The use of the components differs between countries, DSOs and customer contracts.

The network tariff components are (EURELECTRIC, 2016a; Rautiainen et al., 2017):

- capacity-based component (€/kW),
- volumetric component (€/kWh) and
- connection cost / fixed component (€/time period).

Pricing methodologies use one or many of the tariff components introduced above, with different emphasis. Often network tariffs are structured as a combination of one or two of the components, most typically introducing at least the volumetric component for the residential customers.

Dynamic pricing is gaining popularity in the energy transition. Network tariffs are also becoming more variable, reflecting the state of play of the network. Some such tariff methodologies are Time-of-Use (ToU) and Critical Peak Pricing (CPP). Dynamic Network Pricing (DNP) has also been introduced as an idea but has not gained much popularity. In 2015 it was not used in any EU Member State. (European Commission, 2015)

If the customer has a ToU tariff, they pay a predefined fixed tariff for a specific time interval. The amount of the tariff can be determined based on either a volumetric component, capacity-based component or some kind of a mix of these two. (EURELECTRIC, 2016a)

The customer that has a CCP tariff might get a notification, usually 1-2 days in advance, of a higher price during critical hours when the supply struggles to match the demand. (EURELECTRIC, 2016a)

If the customer had a DNP tariff, their prices would fluctuate with short notice, depending on the system use and if there is congestion in the local area. According to a Commission's distribution tariff report (2015), the experience in transmission pricing suggests that schemes addressing capacity scarcity via locational energy price differentiation are more effective than schemes based on dynamic network charges.

4.3 Flexibility services

In the thesis the active customer and how they increasingly take part in the system through flexibility services have been mentioned. This chapter shortly describes the different kinds of flexibility services.

Flexibility can be defined as modification of generation injection and/or consumption patterns in reaction to an external signal (price signal or activation) in order to provide a service within the energy system. (EURELECTRIC, 2014)

Another way to define flexibility is a power adjustment sustained at a given moment for a given duration from a specific location within the network. The five attributes characterizing flexibility service can be defined as (Eid et al., 2016):

- direction,
- power composition,
- temporal characteristics defined by the starting time,
- duration and
- location in network.

The growing need for flexibility comes from the unpredictability of supply and the time difference between demand and supply which, with the use of renewable energy resources, are only increasing. There are three types of use of flexibility identified: procurement of balancing services and activation of balancing energy, managing network constraints and portfolio optimisation (EURELECTRIC, 2014). These are further opened in table 4.

Table 4. Different types of use of flexibility (based on EURELECTRIC, 2014).

Balancing	**Who uses?** TSO	**For what?** To balance demand and supply (frequency stability) through the balancing market
Network constraints	**Who uses?** TSO/DSO	**For what?** To maintain the system (congestions management), to maximise DER
Portfolio optimisation	**Who uses?** Market parties	**For what?** To meet energy obligations by matching (purchase and sale) generation and demand response

When talking about active customers and how they take part in the system by providing flexibility, usually the term in use is demand response. Demand response is defined as

changes in electric usage by end-use consumers from their normal load patterns in response to changes in electricity prices and/or incentive payments designed to adjust electricity usage, or in response to the acceptance of the consumer's bid, including through aggregation (EURELECTRIC, 2016b). Demand response is therefore a flexibility service. As an example of demand response, an hourly changing energy tariff can be offered by the retailer to shape the customers' consumption to the cheaper hours.

Demand response can be either manual or automatic. In manual demand response the customer sees prices for example on a display and makes the decision on their consumption. In automatic demand response the consumption is automatically shifted based on technical signals. The automatic demand response can be agreed between the customer and the aggregator. The flexibility of small households and industries is usually managed by aggregators, either third party or retailers, to pool the generation or consumption of the agreed parties towards the system.

Although flexibility services are used for different purposes, the means and signals are sometimes conflicting with each other. For example high demand response activity has a tendency to increase peak loads in the distribution networks (Rautiainen et al., 2017) resulting in a local need of flexibility in order to avoid or limit the additional network reinforcements. It needs to be noticed that the market based signals sent to end-users are the same for all.

On top of the households and industries, flexibility can be found in new solutions emerging the market. Batteries and storage facilities have the potential to become flexibility tools used by customers, system operators and communities. Also electric vehicles have a large flexibility potential through smart charging and V2G, vehicle-to-grid services.

The flexibility services are not yet in use in a large scale, at least not as described above. However, some kind of flexibility, like day/night tariffs or special daily tariffs based on expected peak in demand or supply, have been introduced already a long time ago in many countries across the Europe. The use of flexibility is expected to increase with the higher share of renewable energy resources, distributed generation, new market players and the smart meter roll-out enabling the new processes and services.

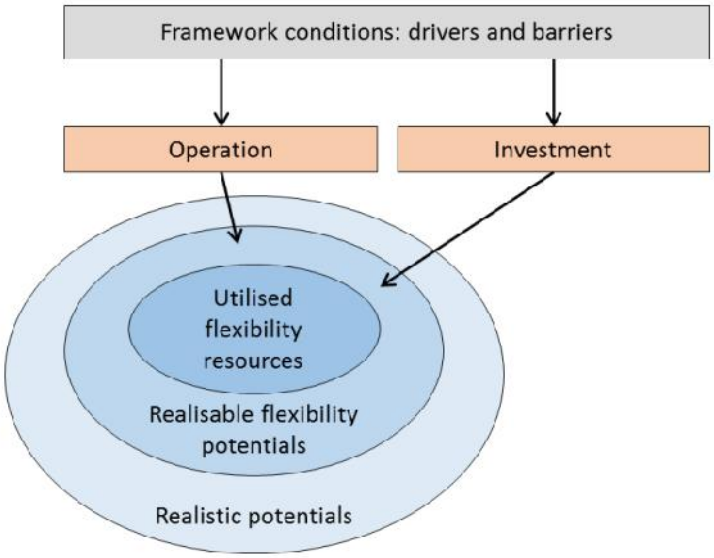


Figure 17. The framework conditions impact on potential and utilised flexibility resources (Bergaentzlé, Boscán, Skytte, Rosenlund Soysal, & Olsen, 2016)

According to a Flex4RES report (Bergaentzlé et al., 2016), flexibility resources, in order to become realisable and to operate flexibly, need the right set of regulatory-based or market-based framework conditions – drivers and barriers. This is showcased in figure 17. The market-based framework is set by the market design, the regulatory-based by direct regulation, fiscal policies and support schemes.

5. NETWORK TARIFFS IN THE ENERGY TRANSITION

In this chapter, the development of distribution network tariffs and the recent discussions are described. Chapters 5.1 and 5.2 focus on the changing network tariff needs and new network tariff structures. The chapter 5.3 focus is on the adoption process of Clean Energy Package from distribution network tariffs point of view.

5.1 The changing network tariff needs

The distribution networks' role is developing with new market players, changing generation scheme, introduction of heavy loads like heat pumps and electric vehicles, growing international business opportunities (through services and solutions) and emerging active customers. More system use opportunities are available with smart metering, but they also enable new types of tariffs. The network tariffs need to be reconsidered from both generation plants' and residential customers' viewpoints in order to avoid the so called death spiral. The death spiral means that the more the customers self-produce, the more the network costs rise for the remaining regular customers. This could incentivise more customers to become prosumers and eventually even lead to disconnections from the grid, which would again increase the network costs for the remaining customers (European Parliament, 2016a). The death spiral is unlikely to lead to a significant amount of disconnections but the challenge of fair cost allocation is important to tackle.

Resulting from the increase in the number of prosumers, increasing energy efficiency and the prolonged economic stagnation, many European countries are already experiencing a significant reduction in distributed energy volumes and, relatively, new challenges in fair cost allocation and predicting incomes. The unpredictability of income increases the risk of tariff fluctuations for the customers. Most Member States still use volumetric tariffs, which reflect the use but not the capabilities and the needs of the distribution network. The capacity component of the tariff better reflects the peak demand and therefore the system needs and costs per customer, at the same time incentivising the customer to reduce the peak load. (EURELECTRIC, 2016a)

The system operators, national legislation bodies and national regulatory authorities as well as the related EU bodies have the pressure to adjust the remuneration and tariff schemes to fulfil the tariff objectives mentioned in chapter 4.2. As the situation is new and the transition accelerating, tariff schemes, principles and best practices are searched for and shared at national, regional and European levels.

With the reconsideration, used structures might find new use or new structures can be implemented. The origin of the problem is similar in the EU Member States, but the conclusions so far on the means of achieving the target vary from Member State to Member State.

Different options are discussed and implemented depending on the energy and customer mix and the structure of the network, but also depending on if the smart meters are in place or not, not forgetting the role of politics. The national decisions risk putting generators and active customers in different position in different Member States. This has led to the observation that the used tariff schemes are not only of local impact any longer. The used network tariffs have an impact on the network investments' or market solutions' profitability and the tariff schemes also determine how effective the market signals can be.

Altogether, the changing system and the new opportunities coming with smart meters have started both national and European discussions on the need of common European network tariff principles.

5.2 New network tariff structures reflecting the changing needs

The new tariff structure design should offer something for the needs of the customer, the network operators, the market and the society. It should also take into consideration the development of technologies, markets and solutions.

Compared to the existing tariffs, the aim from customer point of view is to find a network tariff structure that would better enable the customer to actively impact the network cost and incentivise energy efficiency investments, but at the same time guarantee a clear structure that matches the network tariff objectives. From the network point of view the stable income and neutral market facilitation are the cornerstone for operation and therefore need to be ensured. The network's consumption peaks should not increase as a result. The optimal solution would also enable new offers and services and avoid conflicting with the energy sales. All of this needs to be considered with the capabilities and limitations set by the metering and ICT systems.(Honkapuro et al., 2017)

Council of European Energy Regulators (CEER) published in 2017 a report on Guidelines of Good Practice for Electricity Distribution Network Tariffs. In the report they state that while distribution network tariffs need to recover costs, they also need to send operational and long term investment signals. CEER concluded that there is no definitive optimal network tariff methodology but different approaches, such as a theoretical approach that models a network's long run marginal costs or a model with actual costs, might be found preferable. However, they state that the tariff design should as far as possible be future-proof, the structures should be sensitive to different costs of network

provision, net metering should be avoided, tariffs should recover costs in a way that does not prevent the efficient procurement of flexibility services through competition and a coherent approach across all voltages is needed. They also noted that tariff principles might be compromised at Member State level due to market structure specificities. (CEER, 2017b)

In most of the countries the volumetric component is the most popular at distribution level, the capacity-based component more popularly introduced for larger consumers, such as industries. Almost 70 % of the domestic customers' network tariff was recovered in 2015 with volumetric charges (European Commission, 2015). However, some Member States utilise the capacity-based tariffs also for small household customers and small industries. (EURELECTRIC, 2013)

The trend in discussions has moved towards fixed or capacity based network tariffs. Most DSO costs are fixed, but fixed network tariffs don't enable the customer empowerment or incentivise to consider the network congestions. While the impact of capacity based tariffs is neutral on DSO revenues, they can provide a clear incentive for the customers. Therefore the capacity based tariffs have gained popularity in discussions. (Lummi et al., 2016)

An international study from the United Kingdom identified four broad ways in which distribution network tariffs are being restructured (Hledik, Faruqui, Weiss, Brown, & Irwin, 2016):

- Higher fixed charge
- Demand charge, based on a measure of a customer's peak demand
- Time-varying unit charges
- Inclining block rates (IBRs), a price that escalates with consumption over the course of each billing period

The study also identified pros and cons for each way forward. The higher fixed charge would match the fixed nature of network costs and would collect the minimum amount of distribution costs from each customer. However, small residential customers could find an increase in their network charge and the lack of signals would not promote energy efficiency. The demand charge reflects the system in a way that the costs are much more driven by distribution system peak demand than consumption in total but the concern is that customers wouldn't understand and respond to the new tariff structure. According to the study, the time-varying unit charges would incentivise to reduce the costs by changing consumption patterns or by investing in new technologies but on top of having the same risk as the demand charge there are concerns that a unit charge is not necessarily an appropriate price signal for recovering demand-driven costs. The IBRs encourage energy efficiency and reduce bills but have a vague and more uncertain cost-basis for this tariff structure, which could lead to economically inefficient investment decisions. (Hledik et al., 2016)

The study states, based on an international survey of more than 40 domestic pricing pilots, that statistically significant peak demand reductions accure in response to higher peak period prices. New distribution tariff designs are likely to change the customers' electricity consumption patterns.

A Finnish study (Rautiainen et al., 2017) investigated four alternative tariff structures for the future needs and compared them with present tariff structures in Finland. Currently in Finland a basic charge and a volumetric energy charge with or without time-of-use feature are the most applied tariff structures for residential customers. The four alternative structures that were investigated included:

- Power tariff (PT)
- Threshold power tariff (TPT)
- Power limit tariff (PLT)
- Step tariff (ST)

Of these, the PT consists of basic charge (€/month), energy charge (€/kWh) and a power charge (€/kW) based on peak power, which can be measured and calculated in different ways (e.g. highest hourly power of the month or mean of three highest hourly powers of the month, etc.). The TPT has the same structure but the power charge is used only if a predefined threshold power is exceeded. (Rautiainen et al., 2017)

The PLT has a power charge based on pre-ordered capacity for the month (€/kW). This means that a customer selects a maximum power level and commits to stay within the limit. In case of exceeding the limit, there is a fee or the customer can select to pay for a higher power band. (Rautiainen et al., 2017)

The ST tariff has a basic charge and an hourly consumption charge (€/kWh) paid for every hour separately. The steps, as in the tariff's name, are predefined power limits, and the hourly consumption charge depends on the limit the hourly power exceeds (Rautiainen et al., 2017). In reality this would mean, for example, that a faster charging of an electric vehicle would have a higher price than charging the electric vehicle in a longer period of time.

The study concluded the structure's characteristics from different viewpoints to a table, presented in table 5.

Table 5. PT, TPT, PLT and ST characteristics. (Rautiainen et al., 2017)

	PT and TPT	PLT	ST
cost reflectiveness	very good with the PT due to the existence of the three different cost components resembling the cost structure of the DSOs. With TPT this applies when the threshold power is exceeded	quite good compared to present tariffs, although not as good as with PT as there is no volumetric energy charge or a separate basic charge	moderate, as the power-related cost component is paid for every hour separately, it cannot be very high and therefore the customer can have many high consumption peaks without very high related costs
incentives to change consumption behaviour	potentially good with both, but this depends on how the parameters are set. When the threshold of TPT is not exceeded, the incentives are lower	potentially very good but this depends on how the parameters are set. Also, below the selected power band, there is no incentive to consider the power levels	potentially good but this depends on how the parameters are set. Also, below the limit of higher price, there is no incentive to consider the power levels
compliance with the products of third parties in the electricity sector	good, but the introduction of additional power charge increases the complexity from the customer viewpoint e.g. electricity cost minimisation task, investment calculations of energy efficiency and distributed energy resources	a constant maximum power is a clear boundary condition for different actors like retailers offering for example DR services. However, a constant fixed limit might be too strict in some conditions	a constant maximum power limit for cheaper power is a clear boundary condition for different actors like retailers offering for example DR services. However, a constant fixed 'limit' might be too strict in some conditions, although not as strict as for example in PLT
simplicity seen from the customer viewpoint	compared to the present structures, a new power charge component is added. The concept of power or 'peak power' might not be easy to understand for all the customers, but the same challenge applies for all power based tariffs.	the basic structure is very simple, but when the rules on exceeding the pre-ordered band are considered, the cost formation principles become more complex. Generally, the potential of customers in understanding the concept of power includes some uncertainty	good, but generally, the potential of customers in understanding the concept of hourly power includes some uncertainty
easiness of transition from present tariff structures	Very good, as the weight of the power charge in total pricing can be increased and weights of energy and/or basic charge could be decreased gradually in the transitional phase	transfer aspects are more complicated with PLT, because the tariff structure itself does not well enable smooth transition or transition in small steps. However, this could be tackled by introducing some kind of structure for the transitional period. Another option could be change the tariff overnight, but this approach would require extreme carefulness	good, as the weight of the more expensive step can be increased gradually by modifying the power limit and price difference between high and low price areas

The study (Rautiainen et al., 2017) analysed 32,000 customers of Finnish urban distribution network. Most of the customers were residential customers living in apartment buildings. The study assumed no changes in the consumption behaviour due to the tariff changes to make comparisons clearer in the first phase of the study.

As a result the study found that deviation of the computational revenues with different tariffs from the predefined target revenue is small. In the study, the PLT got closest to the target, but in reality it should be taken into account that some customers would adjust their use based on network tariff signals. (Rautiainen et al., 2017)

The same Finnish study (Honkapuro, S., Haapaniemi et al., 2017) analysed several different tariff structures and their potentials and impacts. The study concluded that introducing the capacity component in residential customers' tariffs is justified for the reasons of cost-reflectiveness and customer empowerment. At the same time it enables new products and services.

Together these two studies from the UK and Finland already give a good understanding of the nationally on-going residential customers' tariff research and discussions. Some similarities are found for the use of network tariff components, favouring the capacity based over volumetric component, but there is no clear recommendation for a structure to be applied in one country, nevertheless at EU level.

The network tariff structure review is not the only considered change in order to reduce the electricity bill's network charge. Where the traditional network design always made sure the new infrastructure would bear the energy consumption of all the customers connected, the AMR and increasing use of flexibility, like the bidirectional capabilities of EVs and storage facilities, have brought and idea of a more cost-efficient way of network planning.

With flexibility services the system operator is able to incentivise the customers' energy use. In a more extreme case the system operator could, in case of demand increasing over the capabilities of the network, agree with the customer to have the possibility to limit the customer's available amount of power. In so-called interruptible tariffs, the customers offering flexibility services would benefit from compensation or from a lower network tariff, and the overall infrastructure costs would be lower reducing the network charge for all the connected customers. The reduction of the network charge wouldn't however eliminate the need of the network tariff review due to the different types of needs mentioned in the beginning of the chapter.

5.3 Network tariffs in the EU framework

Until now the network tariffs have been mentioned in the existing EU energy legislation but no binding, detailed principles for network tariffs have been established. The Third

Energy Package, regulation 714/2009/EC article 14, states general requirements for charges for access to networks. Articles 8 and 18 on the network codes and guidelines also included a possibility to establish binding legislation on the charges for access to networks. The content of the 714/2009/EC is summarised in table 6. It should be noted that the mentioned network code and guideline mandates did not result in a binding network code or a guideline in the area of network tariffs. For gas, the network code on rules regarding harmonised transmission tariff structures entered into force in 2017 (ENTSO-G, 2017).

Table 6. 714/2009/EC key articles related to distribution network tariffs.

Articles	**Key content**
Art. 14	− Covers only charges for access to networks. − Charges to be transparent, take into account the need for network security and reflect actual costs incurred insofar as they correspond to those of an efficient and structurally comparable network operator and are applied in a non-discriminatory manner. − Charges not to be distance-related. − The level of the tariffs applied to producers and/or consumers should where appropriate provide locational signals and take into account the amount of network losses and congestion caused, and investment costs for infrastructure.
Art. 8(6)(k),	− A network code may be prepared in the area of rules regarding harmonised transmission tariff structures including locational signals and inter-transmission system operator compensation rules.
Art. 18(2)	− Guidelines may determine appropriate rules leading to a progressive harmonisation of the underlying principles for the setting of charges applied to producers and consumers (load) under national tariff systems, including the reflection of the inter-TSO compensation mechanism in national network charges and the provision of appropriate and efficient locational signals (as in article 14). − Such Guidelines should make provision for appropriate and efficient harmonised locational signals at Community level. Any such harmonisation shall not prevent Member States from applying mechanisms to ensure that network access charges borne by consumers (load) are comparable throughout their territory.

A study commissioned by DG ENER (European Commission, 2015) called for a clear change on the distribution tariff legislation, but also on DSO legislation in general. The study identified additional EU and national policy objectives apart from traditional policy objectives linked to DSOs in the fields of energy markets, climate policies and security of supply. These objectives included encouraging energy efficiency and the development of distributed energy resources, contributing to system flexibility and promoting the well-functioning of the electricity and gas markets. The tariff schemes in use at distribution level are linked to delivering all of these objectives.

To achieve the mentioned objectives, the study listed DSO related regulation areas which would need to be covered, highlighting network tariffs, smart grids, smart meters, data handling, privacy and security (European Commission, 2015). The smart metering

and data legislation are strongly linked to the tariff legislation as an enabler of network tariff structures.

According to the study (European Commission, 2015), the existing regulation of distribution tariffs is in most Member States consistent with the traditional features of the business: little generation connected and inflexible demand. The structures in use varied from Member State to Member State. The study does not state that the schemes should be harmonised but it is clear that the existing tariffs are not reflecting the EU objectives either. From an efficient transition point of view, the tariff scheme change seems inevitable.

The Commission's proposal for the Clean Energy Package introduced amendments to the EU energy legislation on distribution network tariffs, as well as the other mentioned objective areas, and the study is clearly a source in the making of the proposal. Distribution tariffs and distribution and transmission connection charges are included in the network code topic list, most probably in order to achieve the above mentioned new identified objectives. The network code topic list was in the Third Energy Package (art. 8) restricting but not binding, but now there is an obligation to establish the listed network codes. (European Commission, 2017k)

The identified objectives – DER, energy efficiency and flexibility – all emphasize the customer-centric approach taken in the Clean Energy Package proposal. The Commission's proposal states that distribution network tariffs shall reflect the cost of use of the distribution network by system users, including active consumers. The proposal also emphasizes the possibility to differentiate the tariff based on system users' consumption and/or generation profiles and the role of the regulators. In the proposal, NRAs may introduce time differentiated network tariffs where smart metering is in use, reflecting the use of the network in a transparent and foreseeable way for the consumer (European Commission, 2017k). The Commission also called for further harmonisation at Member States and further harmonisation at transmission and distribution levels, aiming to boost the energy transition through the consumer activation and new technologies and services.

Table 7 summarises all the key amendment proposals in the proposal for regulation on the internal market for electricity (in table 7: electricity regulation) for distribution network tariffs. The reference for the Commission's amendments is the Third Energy Package article 14, as in table 6. It should be noted that the Commission revised the English version of the Clean Energy Package proposal resulting in some wording modifications. The revised version is dated for 23.2.2017.

The table 7 is not exhaustive as it only considers the electricity regulation's key articles related. It does not cover the recitals or possible references in other Clean Energy Package's proposed legislation.

Table 7. The key amendment proposals by Commission for distribution tariffs in the Clean Energy Package. (Based on European Commission, 2017k)

Articles	**Proposed amendments**
Electricity regulation arts. 16(1), 16(2), 16(7), 16(8), 16(9), 16(10)	− Inclusion of charges for connection to the networks, charges for use of networks, and, where applicable, charges for related network reinforcements. − Need to take into account the need for flexibility. − No discrimination between production connected at the distribution level and production connected at the transmission level, either positively or negatively. No discrimination against energy storage or disincentives for participation in demand response. − Appropriate incentives to TSOs and DSOs, over both the short and long term, to increase efficiencies, including energy efficiency, foster market integration and security of supply, and support investments and the related research activities. − Distribution tariffs to reflect the cost of use of the distribution network by system users including active customers, differentiation based on system users' consumption or generation profiles. Where Member States have implemented the deployment of smart metering systems, NRAs could introduce time differentiated network tariffs, reflecting the use of the network, in a transparent and foreseeable way for the consumer. − NRAs to provide incentives to DSOs to procure services for the operation and development of networks and integrate innovative solutions in their systems. − Introduction of performance targets in order to incentivise DSOs to raise efficiencies, including energy efficiency, in their networks. − ACER to provide a recommendation addressed to NRAs on the progressive convergence of transmission and distribution tariff methodologies by 3 month after the entry into force. The recommendation to address at least: (a) the ratio of tariffs applied to producers and to consumers; (b) the costs to be recovered by tariffs; (c) time differentiated network tariffs; (d) locational signals; (e) the relationship between transmission and distribution tariffs, including principles relating to non-discrimination; (f) methods to ensure transparency in the setting and structure of tariffs; (g) groups of network users subject to tariffs, including tariff exemptions. − NRAs to take ACER's recommendation duly into consideration when approving or fixing transmission tariffs or their methodologies.
55(1)(k) 27(1)	− A network code to (art. 27) be prepared in the amended area of rules regarding harmonised transmission and distribution tariff structures and connection charges including locational signals and inter-TSO compensation rules.

A white paper by CEER provided the NRA view on distribution and transmission network tariffs and incentives, responding to the Commission's proposal. CEER stated that harmonisation of network tariffs at European level could be inefficient and bares the risk of unwanted outcomes for European consumers. The guidelines published clarifies this, stating that there are no deterministic rules to determine the right methodology and there is a wide variation in the context in which DSOs operate resulting in different appropriate approaches in different regions (CEER, 2017b). CEER recommended removing the network tariff network code, removing the mandatory approach for regulatory

incentives on DSOs and making a clear distinction between the incentives for DSOs and the incentives for network users. (CEER, 2017a)

Several other stakeholders also commented on the Clean Energy Package's network tariff proposal. EURELECTRIC, representing the common interests of the electricity industry at pan-European level, stated that transmission and distribution tariffs should provide a level playing field and seek to minimise distortions, and welcomed ACER's assessment of the need for progressive convergence of transmission and distribution tariff structures. The harmonisation of the transmission tariffs was welcomed, but EURELECTRIC sees the distribution tariffs as a matter of national regulation, linked to local specificities, and therefore argued against the network code on distribution tariffs. (EURELECTRIC, 2017c)

EDSO for Smart Grids, representing DSOs at European level, stated in their response that integrating renewables and prosumers requires cost-reflective network tariffs that consider local grid conditions and avoid free riding and therefore should be determined at national level. They also argued for more capacity based tariffs at lower voltage levels and recommended to avoid cost socialisation.

Many stakeholders didn't see a need to comment on the network tariff proposals, which could be either because the articles have no impact on their sector or because they are comfortable with the Commission's proposal. For example ENTSO-E, giving the TSO point of view, seemed to be comfortable with the proposals, as well as the European Consumer Organisation (BEUC) who were more focused on the dynamic contracts and billing proposals (BEUC, 2017) in their reaction.

As stated before, smart metering is an important enabler of the energy transition also from network tariffs point of view. In the proposal for a directive of the European Parliament and of the Council on common rules for the internal market in electricity (European Commission, 2017j), the Commission proposed that Member States should ensure the smart metering system implementation using a cost-benefit analysis which considers the methodology the Commission recommends. Proceeding with the deployment, the smart meters should match the minimum functional and technical requirements for smart metering in line with the Commission's recommendation for minimum functionalities. The Member States should also publish these requirements. This would ensure interoperability and connectivity with consumer energy management platforms. All customers' contribution should be ensured for example through network tariffs. The proposal states that all consumers should be entitled to request a smart meter.

Of stakeholders, for example CEER (2017) recommended to maintain a flexible approach to smart meter roll-out, considering both upcoming and existing smart meters. They state that entitling consumers to a smart meter, when the national decision taken is against systematic roll-out of smart meters, would be a disproportionate and ineffective

measure. BEUC highlighted the need for secure and customer-friendly smart metering (BEUC, 2017) and both EURELECTRIC and EDSO for Smart Grids recommend to avoid retroactive requirements for compliance with minimum criteria with existing AMI (EDSO for Smart Grids, 2017; EURELECTRIC, 2017a).

Whereas the reference for the Commission's proposals was the Third Energy Package, for the stakeholders, EU Council and the Parliament the reference is the Commission's proposal, the revised version from February. By autumn 2017 it is only possible to analyse the first reading discussions of the EU legislators: the developments from Commission's proposal to the rapporteur's and shadow rapporteurs' draft report and to EU Council's Energy Working Party's first revision proposal. To clarify the context, figure 18 presents the work in process for electricity regulation and directive from Commission proposal to almost 1 year in the process, autumn 2017. In the figure, key decision-makers are clarified from figure 9 to match the electricity regulation and directive adoption process. On the right of the figure 18 the stakeholder inputs for the process have been described.

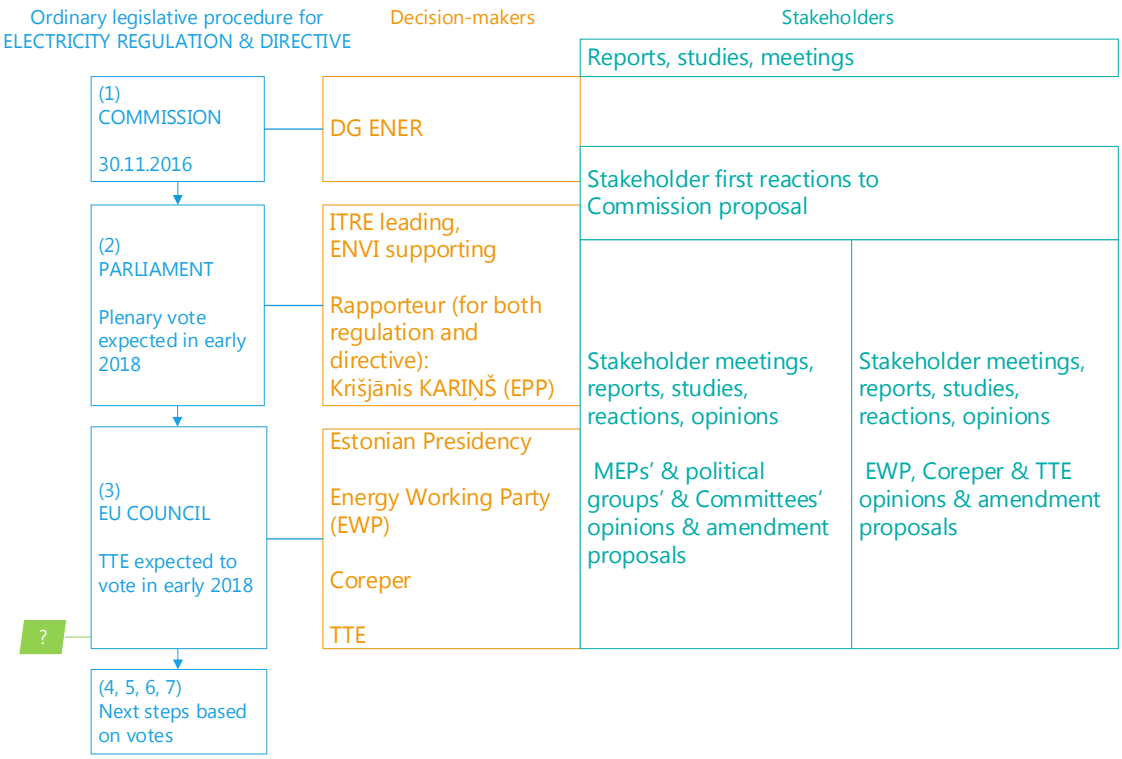


Figure 18. Electricity regulation and directive proposals in the ordinary legislative procedure, situation in autumn 2017.

To give an insight of the procedure's steps 2 and 3 as in figure 18, the EU Council's Energy Working Party's (EWP) first review on electricity regulation and directive, dated 15 September 2017, seemed to agree on the key principles of the Commission's proposal for the amended network charge article, article 16. EWP's main amendments included the deletion of article 16(8) on DSO incentives, leaving only the last part (possible introduction of performance targets). In article 16(9) they changed ACER's recom-

mendation to a best practice report and linked the distribution network tariff related network code in article 55(1) to build on that report. Related to smart meters, EWP's first review proposes to remove the customer entitlement to a smart meter, as per CEER at least proposed. EWP also amended the proposal as per some stakeholders requested, and state that the smart metering provisions in the directive should apply to future installations and to installations replacing older smart meters only. Smart meter systems installed or in installation could remain in operation over their economic lifetime. (EU Council, 2017a, 2017b)

EWP's reviews are preparing for Coreper. With EWP and with further review rounds, Coreper prepares the positions for the vote of the EU Council, in this case TTE – Transport, Telecommunications and Energy Council. Therefore the reviews can be seen as direction-giving only.

The Parliament's amendments are so far many and varying. These rapporteur, shadow rapporteur, ENVI's and other proposed amendments will be compiled to compromise amendments which will go for the leading committee's, ITRE's, vote in December. After ITRE's adopted position, the process moves to plenary. There are trilogues arranged between the EU Council and the Parliament before they vote on their positions. When the Parliament's plenary adopts the Parliament's first reading position, the Commission and the EU Council are likely to amend their proposals based on it. If the EU Council does not agree with the final position of the Parliament, the ordinary legislative procedure continues with the second reading round. If they do agree, the regulation and directive can enter into force as amended.

Based on the amendments so far, it seems likely that most of the Commission's proposed amendments for network tariffs and smart meters, as described, will survive the adoption process. The distribution tariff structures are unlikely to be harmonised in a short time period due to regional and national system specificities but common principles at European level, provided by ACER in a voluntary or by a network code in a binding format, might lead the way towards some harmonisation in the long run. Even if the transition together with the EU legislation would bring the same market players and customer opportunities to all parts of Europe, for example the landscape and population density remain as differentiating factors with major impact on network tariff structures in use.

To influence the network tariff or smart metering related proposals after the first reading, one would need strong evidence to support the change, especially if the Parliament and the EU Council are able to come to an agreement on those topics during the first reading. The efforts for the tariffs could be best placed in influencing the development of ACER's recommendation or the development of a network code on the topic. The network code development starts with the Commission choosing the topics for priority list (influencing the topics through consultation), and continues with the development of

framework guidelines (currently ACER, but this could be changed with Clean Energy Package). With the framework guidelines, the code is to be developed in content by ENTSO-E and, if the Commission's proposal stands through the adoption, through the DSO entity (ACER, 2017).

The EU framework for the distribution network tariffs, when adopted, will impact the national discussions at least in a way that the tariff structures and incentives need to be reviewed to fit the updated framework. However, without the technically detailed network code, or unless the proposals are modified to include concrete Member State actions during the on-going adoption process, the impact of the Clean Energy Package to the existing national tariff practices will remain minimal. For example, most Member States are already considering flexibility in the tariff structures due to national system development and national policies. Some Member States have made even further efforts to better take into consideration the changing electricity system and emerging active customers. For example, the Netherlands already introduced capacity based network tariffs for distribution level small customers in 2009 (EURELECTRIC, 2013). The EU framework will most probably have the biggest impact in the countries where the energy system has not yet seen major modifications, for example the smart metering hasn't been implemented and the generation facilities are mainly centralised, as they have not been in a hurry to review their DSO revenue models.

Although the biggest impact at European level on network tariffs is through legislation, also international, European and to some extent also national standards play a role in the future network tariff framework. One of the key impacts of standards comes with the standardisation of smart metering and communication systems, which provide for the spread of the smart meter and flexibility solutions, enabling the implementation of new tariff structures. Another indirect impact is through distributed energy resources and other electricity system technology related standards, developing the infrastructure and potentially creating further needs for the new network tariff structures. The third standard impact example is smart home related standards, which make it possible for the customers in large scale to actively manage their consumption and production in an easier way. This provides especially for new, more dynamic tariff structures.

The above mentioned standards by topic are likely to be introduced at least at European, if not at international level, in order to provide for further system developments efficiently. The standards are often established for solutions which are established in the legislation, and increasing level of European energy legislation therefore creates the basis for further European standardisation. Often the manufacturers work globally, which means that especially the technology-related standards are likely to be established directly at international standardisation bodies.

6. SUMMARY AND CONCLUSIONS

The objectives of the thesis were to clarify the European strategy and legislative processes and influencing in the field of electricity, to analyse the electricity legislative framework in energy transition and to research and analyse the European electricity legislative framework from residential customer's network tariffs point of view, with the aim to link the analysis to the needs and interests coming with the energy transition.

These objectives where approached with a set of research questions. Chapter 2, The energy legislative framework in the EU, aimed at answering the following of those questions:

- How is the EU energy legislative framework developing in time and how does it pass from EU strategy to implementation?
- What are the influencing opportunities in relation to the European energy legislation and standard frameworks?

Chapter 3, Electricity sector under energy transition, focused on the question on how the energy transition is changing the electricity system and its needs. The chapters 4 and 5, Network tariffs and Network tariffs in the energy transition, focused on the last research question: how have the distribution network tariff needs changed in the energy transition and how does it reflect to the EU legislative framework?

In chapter 2 it came clear that the Lisbon Treaty has led the way towards a constructive European energy legislation framework. The 2020 and 2030 energy strategies both set ambitious targets and a clear way for future strategies together with the 2050 Roadmap. The European energy strategy objectives, which are currently with the Energy Union strategy security of supply, competition and sustainability, have not changed much in the recent decades and the future strategies are likely to follow the same direction. In the future, the Paris Agreement and strategy monitoring results can lead to even more ambitious strategies, resulting in even more ambitious energy legislation. The means and details of achieving the targets are likely to go through a major development through legislation when new technologies and solutions make their way through in large scale and roles and responsibilities settle.

Chapter 2 also described how the energy legislation, policies and standards are produced at European level within a strictly set and complicated framework. The bodies, entities and institutions involved in the processes ensure a wide representation of industries, nations, regions and the EU but also the citizens through the Parliament. The mandated entities, ENTSOs and ACER, have a strong voice in the preparation. More stakeholders, such as industries, technologies or specific regions, can have their interests taken into consideration through the influencing framework: being represented in associa-

tions and organisations, cooperating with recognised decision-makers where possible and participating in workshops, events, working groups or consultations. Different stakeholders and stakeholder interests need a different influencing approach – time, target and means – depending on the influencing target, open opportunities in relation and resources. Chapter 2 also presented a flowchart from strategy to implementation in order to make it easier to understand the relations between European high-level targets and Member State reality. The influencing framework was described also in detail for each part of the flowchart and especially for the adoption process of the legislation, as it is the key influence point for most stakeholders.

Chapter 3 concluded that the transition takes Europe towards a more interconnected but more distributed electricity system with new technologies, solutions, roles and responsibilities. The traditional system and markets as well as legislation and policies need to adapt to the upcoming and already seen changes. The EU legislative framework can guide the way towards a more harmonised, competitive European electricity network and market, at the same time empowering the EU citizens through better decision-making powers, more options for energy use and contracts and a better understanding over the system and market. The risk born in the process is that the detailed legislation aiming for harmonisation and equal treatment of products, services and customers could end up blocking innovation or new solutions. The active customers are emerging with the transition. Even more, the active customers are at the centre of the recently proposed energy legislation, Clean Energy Package, and considered as the key players in reaching the EU energy strategy targets.

The energy transition brings an urgent need for legislation update. Chapters 4 and 5 explain that one of the critical elements to be reviewed is the distribution network tariff framework. In the energy transition, the network tariff objectives remain the same but the used tariffs don't provide for them any longer. One of the biggest risks is with fair cost allocation, and a possible death spiral, but also there is a risk of inefficient signals which hamper the principle of the active customers. The system faces problems when in the transition the distributed energy volumes decrease but peak loads can increase due to more distributed production. The distribution tariff and system problems are solved with more capacity based and fixed network tariff structures and, in an increasing amount, also by utilising flexibility services. National discussions are on-going as there is no clear recommendation for a structure to be applied in one country, nevertheless at EU level. Smart meters are a key enabler of the new tariff structures and the flexibility services.

Chapter 5 also described the network tariffs in the EU framework. The Commission has through studies identified the growing role of the distribution network, and taken note of further objectives to be considered. They also found that the existing network tariffs mainly answer for the traditional system's needs. The Clean Energy Package proposal therefore seeks to introduce common principles which fit the new solutions, needs and

objectives and could provide for the development of the European electricity system. The Commission proposes that the regulators, through ACER, take a role in creating recommendations for tariffs. The Commission also proposes a more detailed and ambitious smart meter legislation at European level. Several stakeholders have reacted to Commission's proposals at the first reading period. The EU Council seems to agree on most parts of the Commission's proposals, and the Parliament will most probably also take a similar position. The first reading period is expected to end in a vote in early 2018. The harmonisation of network tariffs is unlikely although some common principles would be introduced.

To influence the network tariff or smart metering related proposals after the first reading of the Clean Energy Package, strong evidence will be needed if the Parliament and the EU Council are able to come to an agreement on the topics. European network tariff framework could then be best influenced in the development phase of ACER's recommendation or report, or in the development phase of a network code on the topic if the proposal remains. The EU framework for the distribution network tariffs, when adopted, will impact the national discussions, but the impact remains small without a technically detailed network code, or unless the proposal is amended to include concrete Member State actions during the adoption process. The EU network tariff framework is likely to have the biggest impact in the countries where the energy system has not yet seen major modifications, for example the smart metering hasn't been implemented and the generation facilities are mainly centralised.

When writing the thesis, it came clear that the information provided is scattered around the entities' websites and in communication documents, legislation documents, studies, reports and other papers. Some of the information found was in contradiction with each other.

The focus in the EU communication was almost solely on the existing framework. It was very difficult to find the information on the energy strategies as a whole or on how they are related to each other. It was even more difficult to find the relations of strategies, legal acts and Member State reality. This thesis fills a part of that gap, but might yet have deficiencies as an individual study. A further study could take a deeper look into the relations and the stakeholder impact on the processes. Such study could also conclude on the Clean Energy Package adoption process. Also a research approaching this thesis' topics from the Member State perspective could be interesting. Such study could describe the existing distribution network tariff framework, national level stakeholder engagement in the processes and the impact of the implementation of the new European tariff legislation in different Member States – discussions and decisions.

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Annex 1. Total electricity price paid by household consumers (2500-5000 kWh consumption), second half of 2016 (%).

							31,4 %	39,4 %	AVER-AGE
	Total price	of which:			Share in price without taxes and levies		50,8 %	77,9 %	MAX
		energy and supply	network costs	taxes and levies	energy and supply	network costs	16,5 %	13,2 %	MIN
	(EUR per kWh)				(%)		network cost, % of total electrici-ty price	energy and supply cost, % of total electrici-ty price	
Belgium	0,275	0,080	0,102	0,093	43,9	56,1	37,1 %	29,0 %	
Bulgaria	0,094	0,055	0,023	0,016	70,6	29,4	24,5 %	58,8 %	
Czech Republic	0,142	0,052	0,064	0,026	44,6	55,4	45,3 %	36,5 %	
Denmark	0,308	0,041	0,059	0,209	41,0	59,0	19,0 %	13,2 %	
Germany	0,298	0,073	0,066	0,160	52,5	47,5	22,1 %	24,4 %	
Estonia	0,124	0,044	0,052	0,028	46,1	53,9	41,8 %	35,8 %	
Ireland	0,234	0,124	0,064	0,046	66,2	33,8	27,2 %	53,2 %	
Greece	0,172	0,090	0,028	0,054	76,0	24,0	16,5 %	52,3 %	
Spain	0,228	0,123	0,057	0,049	68,5	31,5	24,7 %	53,9 %	
France	0,171	0,061	0,049	0,061	55,4	44,6	28,8 %	35,8 %	
Croatia	0,133	0,058	0,043	0,031	57,4	42,6	32,6 %	43,9 %	
Italy	0,234	0,096	0,046	0,093	67,5	32,5	19,6 %	40,8 %	
Cyprus	0,162	0,091	0,038	0,034	70,8	29,2	23,1 %	56,1 %	
Latvia	0,162	0,051	0,057	0,055	47,2	52,8	34,9 %	31,2 %	
Lithuania	0,117	0,040	0,042	0,035	49,3	50,7	35,4 %	34,4 %	
Luxembourg	0,170	0,058	0,075	0,037	43,8	56,2	43,9 %	34,2 %	
Hungary	0,113	0,048	0,041	0,024	53,6	46,4	36,6 %	42,2 %	
Malta	0,127	0,099	0,022	0,006	81,9	18,1	17,3 %	77,9 %	
Netherlands	0,159	0,065	0,054	0,040	54,2	45,8	34,2 %	40,5 %	
Austria	0,201	0,060	0,062	0,079	49,3	50,7	30,8 %	30,0 %	
Poland	0,135	0,054	0,051	0,030	51,2	48,8	38,0 %	39,9 %	
Portugal	0,230	0,066	0,055	0,109	54,7	45,3	23,9 %	28,8 %	
Romania	0,123	0,044	0,045	0,034	49,3	50,7	36,7 %	35,7 %	
Slovenia	0,163	0,056	0,056	0,051	50,0	50,0	34,3 %	34,3 %	

Slovakia	0,154	0,047	0,078	0,029	37,5	62,5	50,8 %	30,4 %
Finland	0,155	0,050	0,053	0,052	48,5	51,5	34,0 %	32,0 %
Sweden	0,196	0,046	0,082	0,068	35,6	64,4	42,0 %	23,3 %
United Kingdom	0,183	0,102	0,046	0,035	68,8	31,2	25,2 %	55,6 %
Iceland	0,148	0,044	0,072	0,031	37,9	62,1		
Liechtenstein	0,168	0,076	0,076	0,015	49,9	50,1		
Norway	0,163	0,045	0,068	0,050	40,1	59,9		
Montenegro	0,097	0,042	0,045	0,010	48,0	52,0		
FYR of Macedonia	0,083	0,045	0,026	0,013	63,5	36,5		
Albania	0,084	0,070	0,000	0,014	100,0	0,0		
Serbia	0,065	0,022	0,028	0,015	44,1	55,9		
Turkey	0,121	0,065	0,032	0,024	66,7	33,3		
Bosnia and Herzegovina	0,084	0,033	0,039	0,012	46,2	53,8		
Kosovo (1)	0,059	0,021	0,028	0,011	42,7	57,3		
Moldova	0,092	0,060	0,032	0,000	65,5	34,5		

Note: annual consumption: 2 500 kWh < consumption < 5 000 kWh.
(1) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.
Source: Eurostat (online data code: nrg_pc_204_c)